Electrical World

The consolidation of Electrical World and Engineer and American Electrician.

Vol. LIV. NEW YORK, THURSDAY, DECEMBER 16, 1909. No. 25.

PUBLISHED WEEKLY BY THE

McGraw Publishing Company

239 West Thirty-ninth Street, New York.

James H. McGraw, President.

J. M. Wakeman, 1st Vice-President. A. E. Clifford, 2d Vice-President.
Curtis E. Whittlesey, Secretary and Treasurer.

Telephone Call: 4700 Bryant. Cable Address: Electrical, New York.

Editor.....W. D. Weaver
A. S. M'Allister.....Associate Editor
W. H. Onken, Jr.....Associate Editor
T. R. Taltavall.....Associate Editor
J. R. Cravath.....Associate Editor
W. E. Keily.....Associate Editor
W. M. Finley.....News Editor
S. S. Boies.....News Editor
Frederic Nicholas.....Special Contributor

Chicago Office.....590 Old Colony Building
Cleveland Office.....1015 Schofield Building
Philadelphia Office.....Real Estate Trust Building
European Office....Hastings House, Norfolk St., Strand, London, Eng.

TERMS OF SUBSCRIPTION:

United States, Cuba and Mexico.....per year, $3.00
Dominion of Canada.....per year, 4.50
Other Foreign Countries within the Postal Union.....per year, 6.00
25 shillings. 25 marks. 31 francs.

Foreign subscriptions may be sent to our European office.

Requests for changes of address should be made one week in advance, giving *old* as well as new address. No copies of issues prior to January, 1908, are kept on sale, except in bound volumes.

NOTICE TO ADVERTISERS

Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday for the paper dated Thursday of the same week.

Copyright, 1909, by McGraw Publishing Company.

Entered as second-class matter at the post office at New York, N. Y.

The circulation of Electrical World for 1908 was 898,000. Of this issue 16,750 copies are printed.

NEW YORK, THURSDAY, DECEMBER 16, 1909.

CONTENTS.

Editorial 1447
International Congress of Radiology and Electricity 1450
Proposed Steam Railroad Electrification in New Brunswick 1450
Business Telephone Service 1450
Working Independent Telephone System Promised for Chicago 1450
Proposed Railroad Terminal Electrification in Chicago 1450
New York State Telephone Hearing 1451
New England Water-Power Possibilities 1451
The Brailey Telephone Deal 1452
Data for N. E. L. A. Meter Committee 1453
An Electric Gas Meter 1453
Decorative Lighting 1453
Prevention of Smoke 1453
Commercial Engineering 1454
National Independent Telephone Association 1454
Advanced Electrical Engineering Course at M. I. T. 1456
Meeting of Electric Boosters' Club 1456
Work of Accounting Committee, N. E. L. A. 1457
New York Public Service Commission News 1457
Maryland Public Utility Bill 1458
Massachusetts Legislative Notes 1458
Current News and Notes 1459
Generating and Transmitting Equipments of the Tokyo Electric Light Company 1461
The Power Plant of the Harvard Medical School 1462
Factors Affecting the Design of Self-Excited, Single-Phase Shunt Induction Motors.—II. By Val. A. Fynn 1466
A Form for Keeping Isolated Plant Data 1469
Special Lighting at Aberdeen, S. D. 1470
English Gas and Electric Competition. By Glenn Marston 1470
Arrangement of Concealed Conduit 1472
Wiring of Christmas Trees 1472
Ornamental Street-Lighting Posts at Salt Lake City 1472
Large Roof Signs in New York 1473
New Telephone Patents 1473
Letters to the Editor:
Electrical Units and Notation. By Karl Strecker 1474
The Lux as the Unit of Illumination. By F. Laporte 1474
Digest of Current Electrical Literature 1475
New Apparatus and Appliances 1479
Industrial and Commercial News 1484

Export Trade Data.

The figures of electrical export trade for October, just issued, parallel closely those of September in their general character, the foreign demand for instruments improving, while that for heavy electrical machinery still shows a small decline as compared with recent years. The exports of the month in electrical instruments and appliances were $683,819 as compared with $432,907; while the exports of heavy electrical machinery were $443,388 as compared with $543,188. There is a total shown of $1,127,207 as against $976,095 in the month of 1908; or, in other words, the gain for the whole electrical exports was slightly over $150,000. The gain in September was nearly 15 per cent, and the October gain is more than 15, so that it is evident the improvement is being maintained. If there were only the foreign demand for American dynamos and motors that existed before the panic, the trade would apparently have exceeded already the old level. We can only hope that this will soon happen, meantime felicitating manufacturers upon the fact that business is so much better and on so much wider a basis, as relates to the exports of miscellaneous electrical goods.

The Lux as the Unit of Illumination.

Our correspondence columns contain, this week, a letter from M. F. Laporte, of the Laboratoire Central d'Electricité at Paris, on the subject of the *lux* as the unit of illumination. The history of this discussion is briefly as follows: In our editorial columns of the issue of Sept. 23, 1909, we summed up the situation concerning the new international candle, and the new international *meter-candle* derived therefrom. We pointed out that this new international candle is no other than the *bougie-decimale*, which is the only unit of luminous intensity that has received international recognition at the hands of an international electrical congress. Our argument was that the term *lux* should therefore be considered as properly defining the illumination produced by the *bougie-decimale* or new international candle at one meter, as exclusively applicable to the new international meter-candle. The custom recently followed by some German photometricians of using the term *lux* for the meter-hefner was criticised adversely.

Herr Monasch took exception to our criticism in a letter published in our issue of Oct. 28. He pointed out that, as early as 1897, the *lux* had been used in Germany as equivalent to the *meter-hefner*, following the proposals of M. Blondel to the Geneva Conference of 1896. At that date it was stated that the *hefner* did not differ appreciably from the *bougie-decimale*. At a later date the *hefner* was reported to be distinctly a smaller unit than the *bougie-decimale*, in the ratio of approximately 0.9. Consequently, it was no fault of German photometricians if the later determinations divorced the *meter-bougie* from the *meter-hefner*, or the *lux* as defined in France from the *lux* as maintained in Germany. M. Laporte now contends that there is no reason to suppose that either the *bougie-decimale* or the

hefner changed 11 per cent in 13 years. His contention is that the ratio of approximate equality assigned between them in 1896 was necessarily imperfect, and that had the specifications for the *hefner* been defined at that time, as they appeared later, the ratio would probably have been found then substantially what it is now. The situation thus presented raises the question if it might not be advisable to state illuminations in terms either of the new *meter-candle*, the old candles having already lighted themselves into the limbo of ancient history, or of the *meter-hefner*. The term *lux* is shorter than either of these, but is open to some ambiguity. A French or English-speaking photometrician would be likely to use the term *lux* as equivalent to the *meter-candle*, and a German photometrician as equivalent to the *meter-hefner*, so that, unless carefully defined, it might be safer to avoid the use of the lux altogether for the present.

German List of Proposed Symbols.

We print this week in our correspondence columns a letter from Herr Strecker on the subject of national and of international electrical-engineering symbology. The German Committee has had this subject under consideration for several years, and has already rendered great service to the technical literature, not only of Germany, but also of other countries, by its care and its spirit of open recognition of general international welfare. We hope that our American Institute of Electrical Engineers may eventually take action to co-operate, both with the German Committee and with the International Electrotechnical Commission, to bring about gradually a much needed unification of notation in electrical-engineering writings. Such movements of international concert are necessarily slow, but at least they should be definitely directed.

There is almost as great a danger of carrying the ordination of symbols too far as of not carrying it far enough. It is manifest, and needs no demonstration, that such simple formulas as Ohm's law, for example, should be printed in the same notation in all languages. Similarly, there are about a score of quantities constantly recurring in the literature and textbooks of electrical engineering, such as magnetic permeability, electric quantity, etc., that should be represented by the same symbols in all civilized countries. The same proposition applies to other well-established branches of technology. In the literatures of dynamics, of statics, of chemistry, of heat, of sound, and of optics, there is the same need for uniformity of symbols in dealing with formulas that are of very frequent occurrence and great utility. Now there are not letters enough in our usually available printing fonts to meet the demands of all these branches of applied science, nor are human memories ordinarily developed enough to retain the complete schedule of a notational system sufficiently large to embrace them all. It is quite sufficient for practical purposes that one and the same symbol be not in joint demand by groups of technologists whose fields frequently overlap. The whole question is one of expedience and convenience for the purposes of technology. On the other hand, the greatest latitude should be allowed in the notation of the pure sciences. No attempt should be made to force mathematicians, physicists and chemists to use rigid notation in their researches and writings. In the first place, the attempt would be futile, because there are more quantities in nature to be symbolized than there are symbols available for clothing them. In the second place, to fetter a pure scientist's mode of notational expression is, in some degree, to fetter his thoughts; and if we are to make progress, we should enjoy and encourage the greatest possible intellectual liberty. Consequently, the notation of applied science should be standardized, but not the notation of the science as yet unapplied.

A New Field-Magnet Design.

Mention is made this week in the Digest of a new design of field-magnets proposed for direct-current machines. In reality it will be seen that, except in regard to commutating poles and their disposition, the design belongs to a well-known type of several decades' antiquity. It consists essentially of pairs of poles applied to the armature, as though from individual electromagnets, instead of at uniform radial intervals around a common yoke ring. The novel elements in this case are associated with the disposition of the interpoles, one to each pair of driving poles. Moreover, the disposition of the field coils is such as to offer a substitute for half the usual number of interpoles. The contentions made on behalf of the new design for saving in magnetic-circuit iron, commutation-copper, reduced magnetic leakage, and facility for ventilation, are worthy of being investigated by designers. They are questions which are sure to elicit much difference of opinion. The only safe way of drawing conclusions in such cases is to build two field frames for one and the same armature, the first field-frame being of approved design and standard radial construction, and the second field-frame of the new construction. The comparative costs, properties and behaviors of the two types are then capable of being rendered evident by testing. The designer of the new type presents evidence of this character.

Illuminating Engineering in England.

The inaugural address of Prof. S. P. Thompson, F.R.S., as president of the newly formed Illuminating Engineering Society, abstracted elsewhere in our columns, states with admirable clearness the objects of the society and the line to be followed in its work. In particular it draws strenuous attention to the importance of diffusion, especially in case of recent illuminants like the metallic-filament incandescent lamps, the Welsbach mantle and the electric flame arcs. In touching upon this matter he has reached perhaps the most vital point of artificial illumination. There is no escaping the fact that daylight is, when judiciously utilized, far superior in point of comfort to even the best and most skilfully arranged artificial lighting. The reason and remedy for this difference is the greatest problem of illuminating engineering. The chief differences between natural and artificial light are three—color, intensity of visible source, and direction. It is easy enough to duplicate the intensity of ordinary daylight; in fact, this intensity is often exceeded. None of the common lamps gives light even approximating it in color when unscreened. What is worse, all artificial illuminants that can fairly lay claim to high efficiency are of so great intrinsic brilliancy as to bring undue strain upon the eye unless used very cautiously; even granting proper screening, artificial light is localized and directed to an extent quite unknown with natural light.

In ordinary daylight, out of the direct rays of the sun the light which enters the eye and falls upon the retina provides a fairly uniform stimulus. When this condition is not fulfilled, as when one reads out of doors with the light filtering through leaves or otherwise coming irregularly, one feels strain very quickly even when there is no flickering. With artificial light

the direction is sufficiently definite to give usually quite irregular stimulus on the retina. If completely diffused, artificial light is apt to give trouble from lack of shadows and consequent difficulty of definition. Whatever may be the exact causes of the marked difference between natural and artificial illumination, the abolition of the difference is the next great step forward in illumination.

Professor Thompson again touches most important matters in a strong plea for better lighting of schoolrooms, and especially for the actual scientific measurement of the conditions in them instead of merely casual inspection. It seems to be well established that certain forms of myopia are greatly aggravated by working in poorly lighted rooms. In this case both natural and artificial lighting have to be taken into account. The former is often faulty in that it is uneven, the room having dark corners and spots exposed to direct sunlight. The former fault is a very common one, and while the latter can be remedied by the intelligent use of curtains, it is at the risk of aggravating the dark corners. With artificial light it is practically possible to produce more uniform illumination than that usually found by day, although the devices necessary to get first-class results sometimes are condemned as "inartistic" by some ignorant critic, and declined in favor of something utterly worthless. We have in mind one high school in which the interior coloring was settled upon by a lady member of the school committee in accordance with the then popular canons of high art, with the result of making the lighting at all times inadequate, and rendering artificial lighting almost impossible. Professor Thompson makes the very sensible suggestion that the time has now come to define the actual conditions of the illumination in schoolrooms not by architectural rules, but by foot-candles, and proposes that a minimum of 1.5 foot-candles should be required at the worst lighted seat in the room. This is getting fairly down to business and were such a rule to be enforced there would be far fewer dark corners than at present. And this sort of thing is really just what the Illuminating Engineering Society should do, to introduce scientific and exact methods in place of rule-of-thumb, and to make artificial lighting as nearly as may be equal in practical results to natural lighting. One cannot rival sunlight in brilliancy, and yet there is no obvious reason why with the present resources of the art at his command he should not by artificial means obtain the modest intensity of ordinary natural lighting within doors efficiently and well.

THE DESIGN OF SINGLE-PHASE INDUCTION MOTORS.

As the concluding part of his article on the factors affecting the design of single-phase induction motors Mr. Val. A. Fynn gives in this issue a detailed discussion of the advantages to be obtained by providing the motor with a commutator for introducing an exciting magnetomotive force in the secondary circuit. Among the chief results following the application of an e.m.f. to the secondary circuit is the change in the primary power factor, on account of the fact that the magnetic field required for the proper balance between the counter and impressed primary e.m.fs. is produced by a secondary rather than the primary m.m.f. The advantage derived from transferring the exciting m.m.f. to the secondary circuit is attributable to the action of the rotor as a frequency converter; the wattless volt-amperes required for producing a certain value of magnetic field varies directly with the frequency and hence reduces to zero when the secondary frequency has zero value at synchronous speed. Even when the secondary frequency is not zero, and the reactance of the secondary circuit has an appreciable value, it is possible, by the expenditure of a small value of wattless volt-amperes in the secondary circuit, to exert a secondary m.m.f. more than sufficient to produce the field required for balancing the primary impressed e.m.f. and thereby to cause the total motor circuits to take leading wattless volt-amperes from the supply system. In addition to affecting the wattless volt-amperes taken by the machine, the use of an auxiliary e.m.f. in the secondary rotor circuit modifies the speed-torque characteristics of the machine as explained in detail by Mr. Fynn. The exact effect upon both the power factor and the torque depends upon the mechanical position of the secondary axis along which the auxiliary e.m.f. is introduced compared with the primary magnetizing axis, and the time-phase position of the introduced secondary current compared with the time-phase position of the primary counter e.m.f. When the secondary current differs in time-phase from the primary counter e.m.f. by the same number of degrees as there are electrical angular degrees displacement between the secondary axis and primary magnetism, the effect is confined almost wholly to the torque; when the secondary current is displaced by 90 time degrees from this assumed position, with the secondary axis in the former position, the m.m.f. will affect the wattless volt-amperes almost exclusively.

AN INTERESTING FIND.

A recent communication in *Nature* bears the news of the discovery of native tantalum, hitherto unknown, as a sort of by-product of a placer gold mine in the Urals. From a commercial standpoint the yield was negligible, the whole amount collected being only a few grains, but scientifically it adds another to the comparatively meager list of native crystalline metals. The tantalum was in this case associated in the crystalline form with a small fraction of niobium. It is a thing worth investigating to determine if possible the source of the supply. Still more, it would seem not impossible that gold-bearing sands and platinum-bearing sands elsewhere may also carry tantalum which has hitherto gone unnoticed, perhaps in very considerable amounts. The mineral in the case cited appeared as a bright grayish-yellow crystalline powder, the microscopic crystals having a specific gravity of 9, which is far below that of the non-crystalline metal and also much lower than the specific gravity of the precious metals expected in placer mines, and hence not unlikely to escape notice. It is not improbable that careful search may bring rewards in a further search, just as it does in the tailings of many a hard-worked mine. The uses of tantalum are sufficient to stimulate prospecting for it, and if by any good fortune a fairly liberal supply should be found its uses would be multiplied. The present scarcity forbids anything like the use in large quantities that is indicated by the very extraordinary properties of tantalum. Truth to tell, there are not a few of the metals at present rare that could be widely utilized if even moderately reliable sources of supply could be found. A systematic search through metallurgical works for casual products is rarely made, and when made is seldom thorough enough to include looking for the altogether unexpected. The present discovery should stimulate curiosity and may lead to finds of further scientific, if not commercial, importance.

International Congress of Radiology and Electricity.

An International Congress of Radiology and Electricity will meet in Brussels in connection with the International Exposition to be held there in 1910. The congress will meet on Sept. 6, 7, and 8, and will have three sections. In the first section general questions of terminology and methods of measurement in radioactivity and subjects connected with ions, electrons, and corpuscles will be dealt with. The second section will be divided into various subsections, dealing respectively with fundamental theories of electricity, study of radiations (including spectroscopy, chemical effects of radiations, and other allied questions), radioactivity, atomic theory, and cosmic phenomena (including atmospheric electricity and atmospheric radioactivity). The third section will be biological, and will be devoted to consideration of the effects of radiations on living organisms, its subsections dealing with purely biological questions as well as with the use of various radiations for medical purposes, both for diagnosis and therapeutics. In order to ensure the success of the congress, committees have been formed in the various countries which will take part in the congress. Anyone wishing to become a member of the congress should communicate his intention directly to the general secretary, Dr. J. Daniel, 1 Rue de la Prévôté, Brussels.

Corporation Tax Law.

Commissioner Cabell, of the United States Internal Revenue Bureau, has drawn up for the guidance of officials of the bureau a synopsis of the corporation tax law in which it is stated that the law is a revenue measure and should be construed liberally for the purpose of producing revenue for the Government. The real intent of the law is to collect a tax of 1 per cent on the net income, less $5,000, of the individual corporation, joint stock company or association liable to the tax. In order to disclose their net incomes the corporations will be required to file certain official forms arranged for the purpose. It is probable that the collection of the tax will be vigorously resisted in a test case before the Supreme Court of the United States.

Proposed Steam Railroad Electrification in New Brunswick.

A conference will be held at Ottawa, Ont., on Dec. 16 between representatives of the Federal, Quebec and New Brunswick governments, the National Transcontinental Railway Commissioners and the Dominion Railway Commissioners, the Alexander Gibson Manufacturing Company, the New Brunswick Lands & Power Company, the Miramichi Lumber Company and the Grand Falls Power Company for the purpose of discussing the proposal that the Grand Trunk Pacific Railway Company should operate its trains through the New Brunswick forest district by means of electricity, for the generation of which there is ample water-power at Grand Falls on the St. John River. This question was discussed in the Legislature of the Province of New Brunswick at the last session, and the proposed conference is the result of a suggestion made at the time that electric power be adopted by the railway company in order that the devastation of the valuable timber limits within the Province shall be prevented.

Business Telephone Service.

The American Telephone & Telegraph Company is offering a new kind of telephone service under a short period contract for a daily long-distance service. The plan is to connect, for instance, the subscriber's New York headquarters with his New Jersey factory, his Pennsylvania mine, or his Chicago selling agency (or whatever other long-distance call is designated in the contract) at a given hour each day, for a given period of not less than half a hour. There is thus no waiting to call and secure connection, the instruments being connected up ready for immediate use at, say, 4 o'clock every day. In view of the service being regular and taken only before 10 o'clock in the morning, between noon and 1 or after 4 o'clock in the afternoon, which hours are outside of the rush hours, the company makes a special rate which is lower than the regular message rates. The whole plan is set forth in a pamphlet recently issued by the commercial department of the company.

Working Independent Telephone System Promised for Chicago.

At the convention of the National Independent Telephone Association held in Chicago last week an announcement was made by Mr. H. D. Critchfield, of the Automatic Electric Company, that was received with great applause. Mr. Critchfield said that he was authorized to state that financial arrangements have been made that will result in an independent telephone system that will be in operation in Chicago by Dec. 1, 1910. The money has been subscribed, he added, by men of unquestioned financial ability, and the company will connect with independent long-distance lines.

Mr. Critchfield did not say so, but it is surmised that an effort will be made to utilize the telephone franchise of the Illinois Tunnel Company recently placed in the control of receivers. This company's predecessor started out to build and operate a competing telephone system in Chicago, placing its conductors in large tunnels beneath the streets. An exchange was established, using automatic apparatus, and several thousand instruments were placed in the central business district. But, in the progress of events, the company developed its tunnels for carrying freight, and the telephone department languished, having been several years in a quiescent state. The Chicago Telephone Company has expressed a willingness to take over the franchise, but the city has so far refused.

The independent telephone operators in Wisconsin, Illinois, Indiana and surrounding States are anxious to secure entry into Chicago for their long-distance lines, and hence they are greatly pleased at Mr. Critchfield's announcement. It is said that the new Chicago system will have 20,000 telephones in operation within a year. The announcement comes at a time when the new Continental Telephone & Telegraph Company, of New York, is active in acquiring independent telephone properties in Pennsylvania and other States. Whether there is any connection between this company and the Chicago project is not generally known. At the independent convention of last week, however, the Continental Company was spoken of as the backbone of the proposed national independent telephone system to compete with the American Telephone & Telegraph Company, which it is hoped to build up by the reorganization of the old International Independent Telephone Association on a contract basis, as related elsewhere in this issue.

Proposed Railroad Terminal Electrification in Chicago.

At a meeting of the local transportation committee of the City Council of Chicago on Dec. 8 to discuss the proposed ordinance to compel steam railroads to abolish smoke in Chicago, a representative of the Illinois Central Railroad made the sweeping statement that that railroad had eliminated 99 per cent of the smoke previously emitted by its locomotives between Sixty-third Street and the Randolph Street station. It was said that this had been done by the use of smoke consumers, training firemen and using coke and the best grade of coal. The speaker said that one objection to coke was that after burning it for six hours or so the accumulation of clinkers was so great that the

locomotive had to be taken out of service and cooled down so that a man could remove the mass from the fire-box.

Mr. F. A. Delano, president of the Wabash Railroad, said that if electrification were applied to passenger trains alone the change might be possible. Mr. L. C. Fritch, chief engineer of the Chicago Great Western Railroad, suggested that a commission of experts be created to make a study of the terminal situation in Chicago for the guidance of the City Council. A union passenger terminal, or a series of terminals connected by belt lines electrically operated, might go a long way toward solving the smoke problem in Chicago, so far as railroads are responsible for the smoke, in the opinion of Mr. Fritch. Electrification of the present maze of tracks within the city would be unwise and impracticable, if not impossible, in the opinion of that gentleman. The committee decided to draw up a series of questions relating to the experiments being made in the matter of methods for the prevention of smoke and submit them to the various railroads. There is, however, more involved in the proposed electrification than the mere abolition of smoke, for the noise, the noxious vapors, cinders and (in winter particularly) steam from locomotives also constitute a nuisance.

New York State Telephone Hearing.

The most important feature last week of the legislative investigation into the telephone and telegraph situation in New York, by the Legislative Committee, was the testimony of Mr. Theodore N. Vail, president of the American Telephone & Telegraph Company. Mr. Vail reviewed the history of the telephone industry in this country from 1877, when the New England Company and the Bell Company were formed, up to the present time. From the start, he said, it was recognized that one large company could handle the telephone business better than a number of small concerns. Mr. Vail admitted that his company made contracts with its engineers and employees by which it was provided that any inventions or improvements that were made by them became the property of the company, but he specifically denied that the company ever purchased patents or improvements that were available and then refused to use them, as the company was always ready and anxious to make use of every improvement that seemed to be practical. The New England Company, he said, was the first company organized to operate a telephone system, but this was after the voluntary so-called Bell Association was formed, in which there were four partners, A. Graham Bell, Gardner E. Hubbard, C. A. Saunders and Thomas A. Watson.

This Bell Association and the New England Company were later merged into the National Bell Company, which controlled the telephone patents and business of the United States and also controlled the patent rights for Mexico and South America. The National had a capital stock of $850,000, of which $650,000 was given, share for share, to the old stockholders and the balance was retained in the treasury. About a year after the formation of the National Bell Company, the American Telephone & Telegraph Company was organized with a capital of $6,000,000. Mr. Vail said that neither the New England, the old Bell nor the National Bell had ever paid any dividends. The American company, he said, had paid dividends practically from its incorporation, paying from 6 per cent up to as high as 15 per cent.

Mr. Vail said that it was not the habit of the American company to acquire stock control of the different concerns licensed to operate under its patents. In most instances the operating concerns gave to the trust from 30 to 40 per cent of their stock in consideration of the permission to use the patents. At the present time, the American company has outstanding about $250,000,000 of stock and up to the present time about $100,000,000 of the company's bonds have been converted into stock.

In speaking of the printing telegraph machines, Mr. Vail said that the first patents were taken out by the Gold & Stock Ticker Company, which is owned by the Western Union Telegraph Company. The American Speaking Telephone Company also held certain patents, and these two concerns entered into an agreement with the Bell Association in 1879 by which an interchange of patent rights was arranged. The Bell Company was to pay a royalty during the life of the patents to the Western Union amounting to 20 per cent of the net income per instrument upon which certain appliances were used. These payments ceased in 1896, and the settlement of the old claims is still in litigation.

The original Bell patents have expired, but the American company owns patents upon improved instruments which have some years to run. Mr. Vail said that there was now but one licensee operating in New York State under authority of the Bell patents. When asked if his company had any interest in any manufacturing concern, Mr. Vail said that it owned 12,000 shares of the 15,000 shares outstanding of the Western Electric Company. He said he preferred not to state the price that had been paid by the American company for the New York Telephone Company's stock which was recently acquired from the Western Union Telegraph Company. When pressed for an opinion as to whether or not it would be a good thing to have the telephone companies and their rates under the supervision of a commission, he said that the theory had not yet been tried out and he did not feel like expressing an opinion.

In one of the sessions of the committee, last week, Senator D. F. Davis, of Brooklyn, made complaint to the committee against the telephone conditions in New York City, and declared that the business is practically a monopoly and that all competition is shut out. He declared that the Public Service Commission had not accomplished the benefits for which it was organized, and he urged that legislation be adopted which would provide for another commission to regulate telephones and telegraphs. He declared that the New York Telephone Company was arbitrary and unfair in its rates and thought that the Lesislature should take hold of the matter and enact some radical governing laws.

During the week it was developed at the hearings that the New England Telegraph Company bears some very intimate relations to the Postal Telegraph & Cable Company, although it was denied that there was a stock ownership. It was admitted that a portion of the money taken in by the New England Company was deposited in bank to the credit of the Postal Company and that salaries were paid from this account. Mr. Theodore L. Cuyler, treasurer of the New England Telegraph Company, testified to these facts, but he failed to give any very clear understanding as to the relations between the two companies.

New England Water-Power Possibilities.

At a regular monthly meeting of the New England Water Works Association held in Boston on Dec. 8 the Committee on Water and Water Power Diversion, Mr. Charles T. Main, chairman, submitted an exhaustive report which summarized the conditions in New England as follows: "For the purposes of general approximation, we may assume that in New England watersheds without a material amount of storage and with a development up to the yield of the seventh month of an average year, arranged in the order of dryness of those months, there can be obtained an average of approximately 0.09 hp (24-hour power) per square mile of tributary watershed per foot of fall; but the minimum power under such conditions may fall to one-third or less of this amount. With storage the above available power would be appreciably increased, the amount of this increase depending upon the volume and the control of this storage. That is, a yearly average of about one-tenth of one horse-power per square mile of tributary watershed per foot of fall (which corresponds to a maximum 24-hour flow or development of water of about 1.4 cu. ft. per second per square mile of watershed, and a maximum 24-hour net power of 0.12 hp per foot of fall per square mile) may generally be obtained economically, and a correspondingly greater rate of output if the power be used for less than 24 hours per day, and sufficient pondage be available to make such con-

centrated use of the water possible. Thus, a watershed having 45 square miles of area tributary to a dam site having an available fall of 25 ft. may be relied upon to develop an approximate average 24-hour power of 112.5 hp.

The Brailey Telephone Deal.

After several days taken up in argument, Notary Chestnutt decided that F. H. Goff, president of the Cleveland Trust Company, would have to testify in the deposition hearing which was begun in Cleveland early in the week in the case instituted by the minority stockholders to prevent the transfer of the United States and Cuyahoga Telephone properties to the Bell interests. Attorneys for the Brailey syndicate argued that there was no need of a deposition hearing, and that witnesses subpœnaed to testify before the notary could and would refuse to do so. Mr. Chestnutt ruled that he had the authority to require Mr. Goff and other witnesses to testify, or, in case of refusal, to punish for contempt. This was followed by further argument, but the decision was not altered.

Mr. Goff stated that he had sold the United States and Cuyahoga Telephone securities held by the Everett-Moore interests to R. L. Day & Company in the offices of the American Telephone & Telegraph Company. He said he had first approached E. J. Hall, president of the New York Telephone Company, with a proposition to sell him the stock, but after a day or two Mr. Hall replied that the American Telephone & Telegraph Company would not purchase the stock, either directly or indirectly. Mr. Hall then introduced Mr. Goff to W. H. Remick, representative of R. L. Day & Company, and the deal was then consummated. The understanding given Mr. Goff was that the firm would act for the interests of the minority as well as the majority stockholders, and that the companies would be strengthened rather than allowed to degenerate.

Mr. Goff told of a conference of the members of the Everett-Moore syndicate in November, at which he was present. He said he had acted as attorney for the syndicate before taking the presidency of the Cleveland Trust Company, and to some extent afterward. He was asked to take charge of the sale of the stock of the syndicate, but at first refused. Later he agreed to do so, because of the failing health of Mr. Everett and his desire to clear up his business affairs. He was furnished with options by the individual members of the syndicate, including H. A. Everett, E. W. Moore, Barney Mahler, H. M. Hanna, C. W. Wason and J. B. Hoge. The stock optioned consisted of 19,000 shares, or less than 50 per cent of the United States Telephone stock, and some Cuyahoga Telephone stock. There was some stock not held under the voting trust agreement. The minimum price given him for preferred stock was $80, and for common stock $40. The option was to continue for five days, and no limitation as to purchasers was made.

Attorney S. H. Tolls, former law partner of Mr. Goff and attorney for the American Telephone & Telegraph Company, accompanied him to New York for the purpose of introducing him to Mr. T. N. Vail, president of the American Telephone & Telegraph Company. He met Mr. Vail, and later submitted the proposition to Mr. Hall. At the second conference with Mr. Hall, the following day after the proposition was submitted, the refusal was made,, but Mr. Hall stated that possibly some other New York men might be interested. On expressing his willingness to meet the other gentlemen, Mr. Hall conducted Mr. Goff through the reception room of the American Telephone & Telegraph offices to a room adjoining, where he was introduced to Attorney Leverett, counsel for the company. In the room at the time was W. H. Remick, who explained that he was a representative of R. L. Day & Company. The deal was closed there and at that time. Mr. Leverett took part in the conference and drafted the agreement, but Mr. Tolles was not present. He stated that he saw James S. Brailey, whom he knew slightly, in the reception room when he had occasion to step in there, but that they did not discuss the business in any way. Mr. Goff said he agreed to sell the firm 1000 shares of stock in addition to what he had proposed, and these shares were secured from the syndicate and a Cleveland firm. The price was $1 per share above the minimum figures given Mr. Goff. None of the stock was delivered by Mr. Brailey, he said. Arrangements were made for the delivery of the stock and payment for it through the Chase National Bank, correspondent of the Cleveland Trust Company in New York.

Under the agreement Mr. Goff was to secure the resignations of the members of the Everett-Moore syndicate as voting trustees. He said he did this, but that J. B. Hoge objected for some time, and insisted upon knowing the purchasers. This information was not given, as, he said, he felt that he owed it to the purchasers not to make public the information on this point but that he had told Barney Mahler, who represented the syndicate for this purpose.

At the hearing on Saturday J. B. Hoge testified that he objected to giving his resignation as a voting trustee until he knew who had purchased his stock. He said he had been led to believe that it was to go into the hands of the Independent telephone people. He stated that he had been fighting the Bell interests for 15 years, and that he did not think it was right to sell out unless he knew where the stock was going. At a meeting of the trustees he was finally told that all the others had resigned, and that under the circumstances he could do nothing. Mr. Hoge showed considerable feeling in his testimony as to the manner in which he had been treated in the matter.

B. Mahler, another one of the voting trustees, stated that he is still a director of the United States Telephone Company, although he holds but one share of stock. He told of attempting to sell his stock to A. H. Bauer, of St. Louis; Claude Ashbrook, of Cincinnati, and James S. Brailey, of Toledo, some time before the negotiations with Mr. Goff were taken up, but nothing came of it. Later on, he said, he sold the stock to Mr. Goff. Mr. Mahler complained that he should be asked to divulge his private business, but the notary ordered that he answer the questions.

W. L. Carey, secretary of the United States Telephone Company, testified that B. Mahler had led in the attempt to raise the toll rates since Nov. 1. He and Mr. Brailey, Mr. Carey said, are members of a committee which now has this question under consideration. The idea of the attorney for the Independents in bringing up this point is to show that Mahler is now serving the Bell interests in endeavoring to restore the rates to the figures used before they were cut in competition with the Bell companies.

E. E. Newcomb, of the Cleveland Trust Company, was instructed to bring all the records pertaining to the transfer of the stock and such other books and papers as bear upon the case into court. He was on the stand for a short time Saturday.

Attorney J. H. Price has been attending these hearings as the representative of the Attorney-General's office, and Saturday evening was in consultation with that official at Columbus. The Independents believe that as soon as sufficient evidence is brought out to show that the Bell interests are the real purchasers the Attorney-General will take action. Attorney-General Wickersham will be asked to bring suit in the Federal courts also, in an attempt to oust the Bell if it is shown that this sale of stock is to result in a merger.

It is stated here that the Independents have agreed to spend a large amount of money in opposing the Bell companies, and that plans have been made for the reorganization of the national association in such a manner as to bind the Independents together into one powerful rival of the Bell. This will be done by contracts which will be binding even if the stock of the companies is purchased by the opponents.

H. A. Hauxhurst and F. C. Belser, representing Herman C. Stifel, of St. Louis, have begun an examination of the books of the Toledo Home Telephone Company, Toledo. For some reason the company withdrew its appeal to the Circuit Court, and the injunction issued by the Common Pleas Court, preventing interference of Mr. Stifel in his work of examining the books, went into effect. Although it is not known just what the stockholders expect to find from this examination, the supposition is that they will learn something of the disposition of the stock of the company.

Data for N. E. L. A. Meter Committee.

In order that the good features of meter practice by individual companies may be placed before the association, and in keeping with its desire to make the work of the organization cooperatively helpful to the fullest extent, the chairman of the N. E. L. A. Meter Committee is endeavoring to collect additional information for the next report. As suggestive of the class of data required, the committee points to the need of information on meter accuracy and the effect of a testing system upon such accuracy; meter installations, meter testing, tools and appliances; local laws governing meter testing, descriptions of potable inductive loads for testing meters for accuracy on different power factors, frequency for tests of different types of meters, records of jewel life, including polished jewels, diamonds, effect of oil on jewels, etc.; original systems of keeping meter accuracy records, and practice regarding reading meters. The list is by no means exhaustive, and the committee solicits further suggestions. Mr. G. A. Sawin, of the Public Service Corporation of New Jersey, is the chairman of the committee.

An Electric Gas Meter.

At the recent annual meeting of the American Society of Mechanical Engineers, Prof. Carl C. Thomas, of Madison, Wis., presented a paper which describes a meter for measuring the rate of flow of gas or air, and which can be adapted for use as a steam meter or as a steam calorimeter, taking the quality of all the steam passing through a pipe instead of that of a sample of steam. The operation of the gas meter depends upon the principle of adding electrically a known quantity of heat to the gas and determining the rate of flow by the rise in temperature of the gas (about 5 deg. Fahr.) between inlet and outlet. The meter consists of an electric heater formed of suitable resistance material disposed across the gas passage so as to impart heat at a uniform rate to the gas. The resulting rise of temperature is measured and autographically recorded by means of two electrical resistance thermometers, one on each side of the heater. These consist of resistance-wire wound upon metal tubes so placed that all the gas passing through the meter comes in close proximity to the thermometers. The adoption of this principle of operation permits the construction of a very accurate and sensitive autographic meter of large capacity containing no moving parts in the gas passage; independent of fluctuations in pressure and temperature of the gas, and capable of measuring gas or air at either high or low pressures or temperatures. The electrical energy required is about 1 kw per 50,000 cu. ft. hourly capacity, at the pressures ordinarily used in gas mains.

Decorative Lighting.

At the meeting of the New York Electrical Society on the evening of Nov. 30, held in the Engineering Societies Building, Mr. Albert J. Marshall delivered a lecture on public decorative lighting. Mr. Marshall showed lantern views of special street lighting and decorative lighting in various cities throughout the country, and commented upon the features of each. In introducing his subject he stated that New York was behind other cities in the country in the matter of special illumination and decoration. Newark, N. J., he said, was the first instance of special street lighting on a large scale with flaming arc lamps. Many views of the Hudson-Fulton illuminations in New York were also shown.

In the discussion Mr. T. I. Jones spoke favorably of the flaming-arc lamp, and stated that this type of lamp promised to become extensively used in street lighting. These lamps are to be used in the excavation work in the new Brooklyn subway. Referring to streamers in decorative lighting, he stated that it was not advisable to use them for permanent installations. He did not agree with the lecturer that New York was behind other places in the matter of special illumination, and cited "The Great White Way" as an example, although it was only a limited area. Taking the city as a whole, however, the results compared favorably with those in other cities.

Mr. H. T. Owens pointed out that the flaming-arc lamp would not give the best results if hung low. With the ordinary arc lamps this did not make so much difference.

Prevention of Smoke.

At a recent meeting of the Western Society of Engineers, at Chicago, devoted to a discussion of Chicago's smoke problem by the operating engineers of Chicago's large boiler plants, Mr. A. J. Saxe, of the Corn Exchange Building, gave a very practical talk with a demonstration showing how conditions in the boiler-room must be adjusted to prevent smoke.

Mr. Saxe illustrated his talk by means of a common kerosene lamp. The first point he made was on the regulation of the draft to get fuel. He showed that the lamp without the chimney would burn without smoke with the wick turned very low—that is, with a small supply of fuel. By adding a chimney, the wick could be turned much higher and the combustion was more perfect, due to the increase in draft and the consequent increase in oxygen supplied to the flame. He then showed how smoke may be produced in a plant equipped with mechanical stokers by insufficient draft for the fuel being fed to the stokers. He demonstrated the effect in a boiler plant equipped with mechanical stokers where the steam pressure gets too high and the ash-pit doors are closed to reduce the draft without reducing the speed of the stokers at the same time. In a kerosene lamp a parallel case to this is when the lamp is burning without smoke, the wick being turned a certain height and a piece of cloth being wrapped around the lower part of the burner so as to shut off the air supply. The lamp immediately begins to smoke on account of the insufficient draft, just as does the furnace with too much coal for the air supply. When the draft is reduced in a boiler plant, the speed of the stoker should be decreased correspondingly if smoke is to be prevented.

Mr. Saxe called attention to another common cause of smoke in extremely cold weather; namely, lack of air supplied to the boiler-room itself. The plant may work very nicely without smoke until cold weather comes on. When all of the doors in the building are kept closed, the fires smoke for lack of air supply. He illustrated this fact with a kerosene lamp in a closed box, which, when adjusted to burn perfectly in the open air, began to smoke as soon as the box was closed.

Besides the perfect adjustment of draft, it is necessary that there be time for a complete combustion of the volatile gases before they strike the cold sheets or tubes of a boiler. These cold boiler surfaces reduce the temperature of the gases so that they produce smoke just as the insertion of a metal rod into the flame of the kerosene lamp causes it to smoke. To obviate this difficulty on the common horizontal return-flue type of boiler, it is necessary to build the grate out in front of the boiler some distance, a brick arch being put over the grates. With an oven of this kind, the volatile gases are burned before they strike the boiler sheets. This construction, of course, requires additional room in the boiler plant.

In the water-tube types of boiler, other methods than the building of an oven in front of the boilers can frequently be resorted to. With some water-tube boilers fire-brick baffles immediately over the fire give the gases an opportunity to burn before they strike the cold surfaces.

Mr. Saxe illustrated the effect of putting coal on a very little at a time versus throwing on a lot of coal at once, by manipulation of the kerosene lamp wick. The fireman usually prefers to throw on a lot of coal at once, so as to have a longer resting time between his labors. The effect of this method of firing was illustrated by turning the lamp wick very high, thus giving the flame more fuel than could be consumed by the air admitted through the burner. As the fire gradually burned down, the condition was analogous to turning the wick down gradually. When the fire does not have so much coke put on at once, or when the wick is not turned so high at once, there is no smoke.

Commercial Engineering.

In an address recently delivered before the Electrical Engineering Society of Columbia University, Mr. Robert T. Lozier took as a subject, "Commercial Phases of Engineering." He pointed out that in design, construction and operation, commercial requirements will frequently outweigh engineering considerations. In operation, the establishment of a standard rate adapted to the local conditions of a given plant and so adjusted as to equalize automatically between those customers who demand a large station capacity to supply their wants for a few hours of the day as against the customer who has a steady consumption of power for 24 hours in the day, is one of the best illustrations of sound commercialism in engineering undertakings.

The successful sales engineer, he said, does not limit himself to setting forth the engineering advantages of the apparatus which he is handling, but will also carefully point out to the prospective purchaser what the particular features of his apparatus mean to that person in dollars and cents; and when he finds that he has made the desired impression, he stops talking engineering and gets a fountain pen ready for signing the order. In these days of intensified business, it is well to remember that a salesman has generally less than an hour in which to make an impression upon the purchaser, and as there are probably five or ten or perhaps twenty other fellows, each trying to make a sale, time should not be wasted in trying to impress the prospective customer that one is a very decent sort of chap and would rather not force himself forward, but he should go straight to the point, which is to set forth the advantages of the apparatus in one's best manner, so as to convince the buyer that the object is to make a sale.

It is a fact that the engineer, like most professional men, is put in a class by himself in that his opinion, when sought, is generally accepted as being supreme. But whenever he is tempted to take himself too seriously, he should remember that with all of his technical training, highly developed apparatus, transmission lines and transmitting devices, he cannot produce electric light from coal at an efficiency to exceed 2 per cent, while the dissipated firefly produces his nocturnal illumination at an efficiency of 96.5 per cent and doesn't seem to try very hard either. If one is called upon to design a bridge he will doubtless employ a safety factor of not less than 4—because steel is an alloy compound of 13 elements, all of which have a direct effect upon its physical qualities and determine its ability to stand strains and stress. One should be at least equally rational in handling the personal equation, which is not only more complex, but the solution of which yields far more important returns.

Chicago Convention National Independent Telephone Association.

Important action was taken at the thirteenth annual convention of the International Independent Telephone Association held at the Auditorium Hotel in Chicago on Dec. 7, 8 and 9. A very radical plan of reorganization, designed no doubt to stop the leakage of Independent companies to the Bell interests, is under way, and was partially carried out at this convention. The name was changed to "National Independent Telephone Association," and hereafter jurisdiction will be confined to the United States.

By another amendment to the constitution the objects of the association were stated to be, among other things, "to strengthen the union of the Independent telephone companies through the association together of local companies into a more perfect national Independent telephone system; . . . to insure the permanent maintenance of such national Independent telephone system as a competitor of the America Telephone & Telegraph Company and its subsidiary and allied companies or successors, thereby securing to the people of the United States the continuance of the benefits of competition in public telephone service." The constitution was also amended to provide for the election of a board of 17 directors, who shall manage the affairs of the association and elect the officers. Heretofore the officers have been elected by the association itself.

The new board of directors was authorized to increase the dues assessed on each member to an amount not exceeding five cents for each telephone station of member companies. Heretofore this amount has been limited to one cent for each telephone. The old executive committee is abolished, and also all provisions of the old constitution inconsistent with these amendments.

Furthermore, a plan of reorganization was outlined in which some details remain to be perfected, which is to be carried out by the new board of directors, and to which the association formally pledged itself. It is proposed to reorganize the association as a corporate body and to issue stock to member companies in proportion to the number of telephone units represented by each member company, say, one share of stock to 500 units. One unit shall consist of one subscriber's telephone or one circuit-mile of toll line. The association will be made up of company members. The purpose is to make the properties of the members a part of a national Independent telephone exchange. The membership agreement will be in the form of a contract between the member companies and the association, by which the former agree to remain independent for 25 years and exchange business only with one another. This will be a contract that can be enforced by law, and it must be ratified by the directors of each member company. If the stock of a member company changes hands, the obligation will still hold good. This drastic plan, it is believed, will prevent telephone properties from slipping away from the Independent interests, as has been the case in Des Moines, Ia.; Richmond, Ind.; Springfield, Mo., and other places.

The new board of directors, which will be all-powerful in the affairs of the reorganized association, consists of the following named gentlemen: Mr. E. H. Moulton, Minneapolis, Minn.; Mr. Theodore Gary, Topeka, Kan.; Mr. E. B. Fisher, Grand Rapids, Mich.; Mr. O. C. Snider, Kansas City, Mo.; Mr. W. J. Uhl, Logansport, Ind.; Mr. Frank H. Woods, Lincoln, Neb.; Mr. Samuel W. Harper, Wheeling, W. Va.; Mr. Charles West, Harrisburg, Pa.; Mr. Richard Valentine, Janesville, Wis.; Mr. Manford Savage, Champaign, Ill.; Mr. E. F. Day, Council Bluffs, Ia.; Mr. Stephen A. Ward, Mansfield, Ohio; Mr. W. A. Jackson, Detroit, Mich.; Mr. Max Koehler, New York, N. Y.; Mr. H. D. Critchfield, Chicago, Ill.; Mr. Walter E. Doolittle, Chicago, Ill.; Mr. E. A. Boqua, Ft. Smith, Ark.

During the convention the interesting announcement was made that financial arrangements have been perfected which will result in the establishment of an Independent telephone system in Chicago between now and the 1910 convention of the association. This statement, which was made by Mr. H. D. Critchfield, of Chicago, was received with great enthusiasm.

The registered attendance at the convention was about 800, and there was the usual display of telephone exhibits.

OPENING PROCEEDINGS.

At the opening session on Tuesday morning, Dec. 7, an address of welcome was delivered by Mr. Bernard J. Mullaney, secretary to Mayor Busse, to which a felicitous response was made by Vice-President Fisher, Vice-President Holdoegel being in the chair.

The acting secretary, Mr. J. B. Ware, of Chicago, then presented an interesting report. He pointed out that the Independent companies operate about one-half of the six million telephones in use in the United States. While the last year has witnessed restlessness among Independent telephone men and threatened discord, the association still stands firm for fair, legitimate competition in the telephone business. Mr. Ware devoted considerable attention to the telephone statistics as given in the United States census report for 1907. He presented a number of interesting tables made up from the census figures in

groups of States. A table giving a summary of these statistics is as follows:

States.	Total Telephones.	Independent (Non-Bell.)	Bell (A. T. & T. Co.)	Independent with Bell-connection.	Independent exclusively.	No. of Co's.
Eastern	416,773	45,106	371,667	19,601	25,505	366
Middle	1,363,185	394,371	968,814	37,016	357,355	1,598
Central	1,774,534	1,056,253	718,281	258,987	797,266	5,117
Western	1,320,680	992,132	328,929	388,929	603,203	10,356
Southern	709,702	343,223	366,479	96,199	246,024	3,977
Mountain ...	533,704	155,430	378,274	35,148	120,282	1,557
Total	6,118,578	2,986,515	3,132,662	835,880	2,149,635	22,971

Analysis of the census report shows that in the six Central States (Illinois, Indiana, Ohio, Michigan, Wisconsin and West Virginia) there were 80,000 more Independent than Bell telephones, after deducting all the Independent companies having connections with both systems. Excluding Chicago, Milwaukee and Cincinnati, there were 280,000 more exclusively Independent than exclusively Bell telephones in the States named. In the seven Western States of Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota and South Dakota there were more than twice as many exclusively Independent than exclusively Bell telephones in 1907. Mr. Ware closed his report by referring to the defeat of proposed legislation in Wisconsin and Illinois which would cripple the Independents. In Wisconsin it was proposed to place telephone companies under the Railroad Commission as to franchises, thus practically preventing any more telephone companies being started in places now having telephone service. This plan was defeated after strong effort. In Illinois a bill was introduced to permit a telephone company to buy another telephone company or to sell its property to another telephone company. This bill would have legalized the proposed sale of the telephone privileges under the tunnel franchise in Chicago, but the proposed measure was defeated at the very closing hours of the session.

Mr. H. H. Houston, vice-president of the Doubleday-Page Company, addressed the convention on the subject of advertising the telephone business.

TELEPHONE MONOPOLY.

At the session of Wednesday morning Mr. F. Dagger, of Toronto, read a paper having as its title "Is the Telephone a Monopoly?" This question Mr. Dagger answered in the negative. The speaker stated that by competition the telephone service has flourished. In relation to the argument that two telephones cause needless expense to subscribers, the speaker gave statistics showing that in towns in Illinois where two telephone systems exist only 8.8 per cent of the subscribers have duplicate service. Perhaps, also, those using the two telephones would require two instruments in any event to handle their business. Competition has resulted broadly in a general diffusing of telephone service. The speaker gave figures from various cities substantiating this statement. Los Angeles, with competition, has 215 telephones to each 1000 inhabitants. In Chicago, the speaker said, there are 70 telephones to each 1000 inhabitants.

TELEPHONE FIRE INSURANCE EXCHANGE.

Speaking for a committee appointed at the last convention, Mr. J. B. Hoge, of Cleveland, made a report on the telephone fire insurance. The committee has organized a "Telephone Fire Insurance Exchange," a co-operative affair, which solicits a portion of the insurance business of the members of the association. Regular rates are charged. The yearly surplus is to be divided into thirds, one of which would be paid back to the policy-holder and two placed to the credit of a surplus fund. When this fund amounts to $15 per unit installed for each risk, the whole amount of the profits will be divided among the policy-holders. Mr. Hoge explained the details of the scheme, which includes also a provision for income insurance. He made the interesting statement that of an investment of $100 in telephone property, $40 worth is practically indestructible by fire, $40 worth is so widely scattered as to be very unlikely to be burned in any one fire, leaving $20 on buildings, switchboards, equipment, etc., which should be protected by insurance.

REORGANIZATION OF THE ASSOCIATION.

The amendments to the constitution and the plan of reorganizing the association, to which reference has previously been made, were presented to the association on Wednesday morning by Mr. Frank H. Woods, of Lincoln, Neb., chairman of the committee on amendments to the constitution. By unanimous vote the constitution was amended in the manner heretofore outlined. By resolution also the new board of directors was instructed to carry out the plan of organization heretofore described.

Mr. Woods, representing the board of directors, made an appeal for funds to finance the new plan of reorganization. He explained that the association will proceed temporarily under the old organization until the new membership contracts are ready. It is proposed to raise a fund of $50,000, to be used principally in putting the new plan into effect. The representatives of operating companies present were asked to pledge $50 per 1000 telephones to this fund.. In all, $9485 was subscribed at the session, making, with $10,000 previously subscribed by the Continental Telephone & Telegraph Company, nearly $20,000 towards the $50,000 fund.

TECHNICAL AND OPERATING CONFERENCE.

In opening the Technical Conference session, over which he presided on Tuesday afternoon, Mr. R. G. Johnston read a paper explaining the general object of this practical side of the convention work. The general subject treated was economy in telephone service. The discussion was continued by Messrs. Harry N. Tolles and J. H. Ainsworth.

Mr. Arthur Bessey Smith, of Chicago, former assistant professor of telephone engineering at Purdue University, read a paper on "The Telephone and the School," in which he advocated technical training for telephone men. Prof. Volney D. Cousins, of Purdue University, followed with a paper on "An Apprenticeship Course for Telephone Engineers." He advocated the establishment of an apprenticeship course by operating telephone companies.

TELEPHONE ENGINEERING.

"Economy of Proper Engineering" was the subject of a paper read by Mr. Kempster B. Miller, of Chicago. The speaker pointed out that good engineering and good management should go hand in hand. Beginning with the preliminary report on any telephone service proposition, engineering investigation and advice are constantly required. The engineer should lay out and supervise a telephone plant that will make the very best use of every dollar spent. From two-thirds to four-fifths of the investment in telephone properties is in buildings, wires, poles, conduits and the like, which are often left to the care of foremen of insufficient ability. Reports should be regularly made from various departments to the company's consulting engineer, so that he may detect any waste or inefficient administration. The work of the engineer has received too little consideration from Independent telephone companies, and Mr. Miller made a strong argument in favor of improvement in this respect.

OTHER TECHNICAL CONFERENCE PAPERS.

Mr. John W. Coffey, of Indianapolis, read a paper on "Office Accessories" at the Wednesday afternoon session. He spoke of the desirability of using modern office appliances by telephone companies. Mr. W. S. Vivian, of Grand Rapids, presented a paper entitled "Methods of Increasing Toll Business." He described the plan of co-operation adopted by the Michigan Telephone Traffic Association, one feature of which is the meeting of long-distance operators held at frequent intervals. "Patents" was subject of a paper read by Mr. Max W. Zabel, of Chicago. While praising the United States patent system in general, Mr. Zabel said that there is some difficulty in enforcing patent rights after they are granted. To reduce the expense of litigation, he advocated a reform in the taking of testimony. There should be improvement in the Patent Office, so that when claims are allowed the patentee may have reasonable assurance that they will not be found subsequently to have been anticipated.

The subject presented by Mr. J. P. Boylan, of Cleveland, was "Economy of Training Operators." Mr. Boylan advocated such training as of a decided economic advantage. The opera-

tor should not gain her experience at the expense of the public.

At the closing session of Thursday morning, a paper written by Mr. H. E. Davis, of Topeka, Kan., was read in his absence by Chairman Johnston. The subject was "Operators and Trouble Men."

Mr. C. H. Judson, of Seattle, spoke of the evils of free telephone traffic. He mentioned the surprising facts that 8 per cent of all conversations in the residence districts in Seattle were more than 30 minutes each, and that the average conversation in these residential districts was of 7.5 minutes' duration. The speaker advocated the extension of pay stations to clear the system of the enormous amount of free traffic.

Mr. Franklin H. Reed, of Chicago, followed with a talk on "Co-operation." He said that the Independent telephone business in particular is absoluteiy dependent on co-operation in its broadest sense. An intelligent use of technical journals, by preserving the issues and consulting the indexes, is an effective example of co-operation. Mr. Johnston reverted to the desirability of establishing working libraries of books and journals in telephone exchanges. Mr. Ainsworth added that suggestion boxes and departmental meetings of employees furnish effective co-operation.

Advanced Electrical Engineering Course at Massachusetts Institute of Technology.

During the past year, the regulations for the degree of Doctor of Engineering at the Massachusetts Institute of Technology have been made more definite and have been placed in the hands of the board, which also administers the regulations for the degree of Doctor of Philosophy. The requirements for the degrees of Doctor of Engineering and Doctor of Philosophy have now been made substantially equivalent, so far as the period of study and the candidate's attainments are concerned. The Executive Committee has voted to maintain two Austin research fellowships carrying a grant of $500 each and the remission of tuition fees, which are now to be open equally to candidates for the Doctor of Engineering and Doctor of Philosophy degrees. In addition to these Austin fellowships, other graduate scholarships and fellowships are maintained, numbering 15 this year.

During the present year 17 candidates for advanced degrees have been awarded fellowships or graduate scholarships. Two of these were for the encouragement of advanced study in Germany by graduates of the Institute of Technology and the remainder for the encouragement of advanced study in the Massachusetts Institute of Technology.

The number of candidates for the Doctor's degrees in Engineering and Philosophy have this year increased largely over the number of candidates last year. The increasing importance of this work at the Institute of Technology has led to a more effective organization of the arrangements for carrying on the work. The number of students entered as candidates for the Master's degree are also considerably increased over last year.

The advanced instruction in the theory of alternating currents and electrical transmission of power accompanied by advanced research is continued this year under the direction of Dr. Harold Pender, whose investigations in these branches are well known. Professor Pender's duties in the electrical engineering staff of the Institute of Technology include the direction of the important undergraduate course in the elements of electrical engineering which is provided for the junior students in electrical engineering and electrochemistry, and the naval constructors who are detailed by the United States Government for study at the Institute, and also include the advanced lectures for graduate students just referred to on alternating currents and the transmission of power and the investigations and research carried on by such students. Other work carried on by the department for the benefit of students desiring to do original research or who are studying with a view to obtaining advanced degrees, include the lectures and investigations under Professor Jackson on the organization and administration of public service corporations, and instruction in the designing of electric plants by Professor Wickenden. Various researches are now going on in the electrical engineering laboratories in connection with this graduate work.

In addition to the growing importance of the advanced study and research carried on by the electrical engineering department at the Institute, the undergraduate classes are growing rapidly, and this is particularly true of the junior and senior classes, which are recruited to a considerable degree by graduates from the humanistic or scientific courses of other institutions.

Forty per cent of the men who were graduated from the electrical engineering course of the Institute at the last commencement had previously received college degrees and had thereafter spent from one to three years in the electrical engineering studies at the Institute of Technology. The increased number of students following the electrical engineering instruction is particularly felt in the laboratories, and the number of student hours of instruction in the electrical engineering laboratory is now approaching a figure about twice as great as it was three years ago.

Meeting of Electric Boosters' Club.

About 150 members attended a meeting of the Pittsburgh Electric Boosters' Club held on Nov. 29. This club includes among its membership representatives of all electric interests in Greater Pittsburgh. It is organized on the lines of similar clubs in other cities and yet embodies in its essentials distinctive points among which may prove of interest, the nomen clature given to its officers, who are as follows: Mr. L. J. Kiefer, master controller; Mr. Aux. Henry Harris, auxiliary master controller; Mr. Ludwig Hommel, recording wattmeter; and Mr. C. B. Cushing, master electrotype.

The club meets for dinner weekly and holds monthly meetings for discussion of subjects of special interest to the membership. At the November meeting a paper entitled "Seventeen Years of Development in the Controller Industry" was presented by Mr. A. P. Munning. The speaker first referred to the fact that with the development of power-saving appliances when used with electric motors, the question of proper controllers had become so important as to practically dominate to a large extent the use of motor appliances, comparing it in this respect with conditions existing 17 years ago, where the controller was looked upon as purely a necessary evil in connection with the motor, and was designed essentially by rule-of-thumb. For instance, in 1892 a 1-hp, 220-volt starting rheostat, without any automatic features, sold for from $20 to $25; its dimensions were 24 in. x 24 in. x 18 in., and its weight about 60 lb.; to-day the same device with automatic features sells for approximately $3; its size is 9 in. x 9 in. x 4 in., and its weight 11 lb.

He referred largely to the development period occurring between 1892 and 1896, and beginning with a very simple automatic release, outlined and explained the various steps which had taken place since that time in the design and manufacture of controllers up to, for example, the intricate and massive controllers at present employed in steel-mill practice at Cary, Ind., and at Aliquippa. As an instance, he referred to the 1500-hp, 2200-volt, multiple-lever type speed regulators used at the Edgar Thomson Works of the Carnegie Steel Company, where the final contacts on the controller are arranged to carry 10,000 amp and the resistors for each controller consist of approximately 5000 ft. of culm T-rails. He also referred to the extensive use of self starters in connection with compresors, electric elevators, valve control systems, etc.

Mr. Munning referred to the subject of printing-press control, outlining in a general way the types of controllers used, beginning with the Hoe sextuple and octuple presses down to the simplest form of controllers for press work used with the ordinary cylinder or flat-bed types. In the use of larger motors for steel-mill work, attention was called to the application of the series-relay type of controller, and the speaker stated that

before the advent of this construction, mill tables were not as successfully operated, since the drum-type control previously employed involved a much greater strain on the machinery, required harder service on the part of the operators, and involved the use of a larger amount of time than with the new types. It was pointed out that the motors on mill tables are often times required to be reversed from full speed in one direction to full speed in the opposite direction under full-load conditions in from three to four seconds, approximately seven times per minute, for 24 hours per day, for six days per week, all of which involved the most rugged types of controller construction that could be designed.

Work of Accounting Committee, N. E. L. A.

A meeting of the committee on accounting of the National Electric Light Association was held at the headquarters in New York on Nov. 16 and 17. The sub-committee on uniform accounts and practices held a meeting at the same time.

The committee will prepare a classification of construction and operating accounts in such a manner as to meet the needs of companies of various sizes. The classification will divide companies into four classes, according to their gross revenue, as follows: $25,000 and less; $25,000 to $100,000; $100,000 to $500,000; $500,000 and over.

It has also been decided by the committee to issue a pamphlet outlining the principles of accounting and their application to electrical properties and giving explicit instructions to guide companies in their accounting methods. Forms will be included in the pamphlet.

New York Public Service Commission News.

A plan for a system of subways was submitted to the Public Service Commission last week which contemplated practically surrounding all of the boroughs of Greater New York. This plan was prepared by E. J. Farrell, John J. Hopper and associates. It proposes to build East Side and West Side subways through Manhattan and the Bronx, with five cross-town loops connecting them to a tunnel under the East River to Brooklyn, and there connect with the Fourth Avenue subway, and later cross from Fort Hamilton, under the Narrows, to Staten Island. It also contemplates a Fifty-ninth Street cross-town subway under the East River into Queens, reaching several of the more important Long Island points. The total expenditure involved in this system is estimated at about $130,000,000. Mr. Farrell was connected with the building of Sections A and B of the Canadian Pacific Railway, and has done other important work for the Dominion Government.

The Public Service Commission has decided that the recent order regulating the heat in cars must be posted. This was the portion of the order to which the railroad companies objected, claiming that it would result in many complaints that were unjustified. The commission, however, is disposed to think that the posting of the notices will enlist the co-operation of the public in having the proper conditions maintained.

The Interborough Rapid Transit Company has promised the Public Service Commission that it will install 16-cp lamps without shades on both the subway and elevated cars. The installation, it is said, will require two or three weeks, and will cost about $25,000. There has been no agreement made as to the lighting of subway stations.

The commission was informed last week that the Bradley-Gaffney-Steers Company will adhere to the comprehensive plans for subway construction which it proposed some time ago. The company is only waiting for the commission to advertise for bids for subway construction. The many proposals which have been made since the Bradley plan was outlined have not in any way changed the views of that company.

According to a decision made last week by the Supreme Court of New York City, the present Board of Estimate and Apportionment cannot pass upon the proposed modifications of the franchise of the South Shore Traction Company, which is operating surface cars over the Queensboro Bridge. The board proposed to modify this franchise at its meeting on Dec. 23, but the court holds that a longer time is necessary to hear from taxpayers and other interests. The matter will, therefore, go over until the new city administration is in office.

The Board of Estimate and Apportionment has unanimously authorized the issue of $13,036,381 in corporate stock of the city of New York for the construction and completion of the six sections of the Fourth Avenue subway in Brooklyn, the contracts for which have been let.

The Public Service Commission, Second District, has sent notices to all gas companies in the district of a conference to be held at the office of the commission, Albany, to consider the necessity for a new standard in measuring the quality of gas. The quality is now measured by the photometric standard, by which gas is judged for its illuminating power. This standard has been in use for a number of years. For the past 14 months the Division of Light, Heat and Power of the commission has been engaged in a study of various features of the gas supply. The results of the inquiry, as embodied in a report of H. C. Hazzard, chief of division, to the commission discloses that the illuminating power of gas is no longer of primal importance, and that the real value of gas to the average consumer now lies in its heating power. This situation having been shown to exist, the commission at once decided to place the full results of the investigation before the companies, and to summon their representatives to Albany for a general discussion of the subject. This step may lead to the adoption of a "calorific" standard. If this result follows, it will mean that hereafter the gas supply must measure up in heat units to the new standard. Before such action is taken, however, the Legislature will probably be called upon to amend the Public Service Commission law. As it now reads, the law evidently restricts the authority of the commission to fixing "the standard of illuminating power" of gas to be manufactured or sold, not alone for lighting, but for "heating or power purposes," a function the illuminating power cannot fulfil.

The importance of the heating power of gas is due considerably to its extensive present-day consumption for fuel purposes and the prevailing use of the Welsbach mantle in lighting. The light secured from mantles is not dependent upon superior candle-power of the gas, but to the high temperature which the mantle is capable of attaining. A standard by which is determined and regulated the illuminating power of gas is of service, therefore, only in measuring the value of gas to those who use it in open-flame burners for lighting. That those who use gas in this manner constitute a minority of the gas consumers, and that the value of the gas furnished to the majority should be standardized, is the opinion of Mr. Hazzard, who summarizes the results of the inquiry as follows:

(1) That of the coal gas, carburetted water gas and mixed gas furnished within the territorial jurisdiction of this commission, the proportion used in open-flame burners probably does not exceed 20 per cent of the total supply. (2.) That the existing photometric standards by which is judged the illuminating power of the gas afford the proper basis of measuring the real value of this proportion of the supply. (3.) That unless and until the amount of the gas supply used in open-flame burners becomes diminished considerably below its present proportion of the total gas consumed, it is desirable that the existing photometric standards be maintained. (4.) That the present test for illuminating power is not suited to a determination of the real value of gas used in the various methods now employed in incandescent lighting, nor does it afford a proper standard of measure for gas used for heat and power. (5.) That the amount of gas used in these methods and for these purposes constitutes fully 80 per cent of the total gas supply. (6.) That the real value of this proportion of the gas supply lies in the heating properties of the gas, for which no standard of measurement exists in this State. (7.) That by reason of the large class of consumers to whom the value of gas as a generator of

heat is a matter of primal importance, it is desirable that the calorific power of gas be standardized by the introduction of appropriate tests."

The report of the chief of the division presents fully an analysis of the heat units found in the gas supply as at present manufactured and distributed without heat-unit regulations, and a discussion of the relation, if any exists, between the calorific power and illuminating power. This analysis is based upon upward of 700 tests made of the gas furnished by each company in the State.

The Public Service Commission, Second District, will hold a hearing the present week on the application of the Bennington & North Adams Street Railway Company for approval of a declaration of abandonment of a portion of its railroad in the village of Hoosick Falls; on the application of Moritz Mayer for consent to exercise franchises and operate an electrical plant in Camillus, Onondaga County; on the complaint of the Oneonta Common Council against the Oneonta Light & Power Company as to electric-lighting service rendered in that city and the complaint of residents of West Davenport as to station accommodations afforded by the Ulster & Delaware Railroad at that place, and a further hearing on the application of the Hornell-Bath Interurban Railway Company, which is seeking permission to build an electric road from Hornell to Bath, Steuben County.

Of 6220 meters tested in October, 1909, according to the reports filed with the New York Public Service Commission, Second District, 3998 were tested on the premises of companies and 2222 at plants. Of the total number 4507 or 72.46 per cent were accurate; 583 or 9.37 per cent were fast, and 1130 or 18.17 per cent were slow.

Maryland Public Utility Bill.

Attorney-General Strauss, of the State of Maryland, has completed a draft of a public utilities bill which he was requested to prepare by Governor Crothers and the other members of the Governor's cabinet. The measure includes by express provision railroad, gas, electric, power, refrigerating and heating, telephone, telegraph, water and other public service corporations. It provides for the regulation and control at just and reasonable figures of their rates and schedules of prices, of the quality of the service rendered to the public, and calls for the valuations of their franchises, property and plants; it also establishes systems of auditing and accounting and the control over the transfer of franchises and the insurance of stocks and securities. From the decisions and orders of the commission an appeal to the courts is provided. The bill is drawn mainly on the lines of the New York Public Utilities law passed in 1907, with features worked into it from the Wisconsin and Massachusetts acts, the report of the Connecticut commission and the bills introduced into the legislatures of New Jersey and Ohio.

The commission is to consist of three members appointed by the Governor. Their term of office is to be two years, and they are eligible to reappointment. The chairman of the commission is to be designated by the Governor. General and assistant counsel for the commission, necessary experts, etc., are also provided for.

The commission is given full power to summon witnesses with books and papers, and to compel these witnesses to testify. Each Commissioner may hold separate hearings, but his findings or decisions must be ratified by the commission before becoming effective. The commission is given jurisdiction and supervision over all of the railroads and common carriers lying within the State of Maryland. Among the powers vested in the commission with respect to gas and electric corporations are those of general supervision of all persons and corporations having authority under any general or special law or under any charter or franchise or under any ordinance of any municipal corporation or right granted by any county to lay down, construct or maintain pipes, mains, conduits, ducts, wires, poles or other fixtures and appurtenances in, over or under the streets, roads, highways or public thoroughfares and places of Baltimore City or any other municipality or of any county in the State for the purpose of transmitting, furnishing, selling or distributing gas, or of furnishing or transmitting or selling electricity for light, heat, fuel or power, or maintaining underground conduits or ducts for electrical conductors; of investigating from time to time the quality of gas, either natural or artificial, supplied by such persons or corporations; to examine the methods employed by them in the manufacture and supplying of gas or electricity, and to have the power of ordering and requiring such improvements as to quality and service as will best promote the public interest. It will also have the power to fix the standard of illuminating power and purity of gas, and to prescribe methods of regulating the electric supply system; to require all gas distributed or sold to equal the standard so fixed, and to establish regulations as to pressure at which gas shall be delivered; to make all inspections and investigations of the methods in manufacturing or transmitting or supplying artificial gas and in delivering and supplying natural gas, as well as electricity.

The commission is to have power to prescribe and require uniform methods of keeping accounts, records and books by such corporations; to require annual reports from their officers respecting their authorized capital stock and the amount thereof issued and outstanding, as to its bonded indebtedness, as to its receipts and expenditures during the preceding year, the amount of dividend upon stock and interest upon bonds, salaries or officers, location of plant or plants and full description of property and franchises, and also power to examine books and affairs and to compel production of books and papers. Provision is made for inspection by agents of the commission of gas and electric meters.

Transfers of franchises can only be made subject to the approval of the commission. Elaborate provision is made for the reception and hearing of complaints as to quality and to price of gas and electricity, for the investigation thereof by the commission, for notice and hearing, and for rendering of decisions and orders by the commission fixing just and reasonable prices, or requiring improvements in quality or service. Penalties are provided for violations of orders. The act provides for appeals to courts from any order of the commission upon the ground that the same is unjust, unreasonable or unlawful, and further provision is made for an ultimate appeal to the Court of Appeals.

Massachusetts Legislative Notes.

In anticipation of the forthcoming session of the Massachusetts Legislature, the Boston & Eastern Electric Railroad Company has filed with Secretary of State William M. Olin a petition for the right to construct a tunnel under Boston Harbor and the city proper to Post Office Square. The Massachusetts Railroad Commission has informally expressed its approval of the establishment of additional transportation facilities in the district which the Boston & Eastern desires to serve, and the Board, together with the Boston Transit Commission, will report to the next Legislature in a few weeks under what conditions, if any, it considers an entrance into Boston should be made in connection with the project. The company plans to furnish very high speed interurban service between Beverly, Salem, Lynn and Boston.

A petition has also been filed with the Secretary of State for the construction of a subway loop in connection with the Boston terminus of the Cambridge subway, the latter now being built by the Boston Elevated Railway Company within the limits of Cambridge. A number of large business interests in Boston are behind the petition, which plans for a double-track loop about 4300 ft. long, starting from the proposed terminus of the Cambridge subway at Park Street, and running below the present Tremont Street subway to Scollay Square, where the line would swing to the west through Bowdoin Square and under Cambridge Street to connect with the out-bound track of the Cambridge subway. The estimated cost of the work is $1,750,000.

CURRENT NEWS AND NOTES.

INDIANA ENGINEERING SOCIETY.—The thirtieth annual convention of the Indiana Engineering Society will be held at the Denison Hotel, Indianapolis, Jan. 13-15, 1910. An engineering exhibition will also be held. Mr. Charles Brossman, Union Trust Building, Indianapolis, is secretary.

RAILROADS PAY FOR STREET LIGHTING.—The city of Indianapolis has presented bills to the railroads entering the city for 30 per cent of the cost of maintaining arc lamps at street railroad crossings since June 1, 1907. An ordinance providing such payment has never before been complied with, but the railroads express willingness to do so now.

ELECTRICAL SUPPLIES FOR GUATEMALA.—As the outcome of the special legislation giving the Guatemalan Government direct supervision of all electrical enterprises, a presidential decree of Oct. 21, 1909, allows the importation of electrical supplies only on written permission granted by the War Department upon application. The decree also requires such enterprises now existing to furnish to the competent authority the description and destination of all orders for material placed before the promulgation of the present law.

CURB TO PUBLIC SERVICE COMMISSION.—The Court of Appeals has set aside the refusal of the Public Service Commission of the Second District of New York to authorize an issue of bonds by the Delaware & Hudson Company to pay for securities of the Hudson Valley Company. The court held that the Legislature did not intend to make the commission the financial manager of corporations or empower it to substitute its judgment and discretion for that of the directors and stockholders of a corporation as to the wisdom of a transaction.

SEARCHLIGHT ON NORTH CAROLINA COAST.—The United States Government will shortly install three powerful 60-inch dial searchlights at the mouth of Cape Fear, 30 miles below Wilmington, N. C., according to recent announcement. The new lights will be located on 150-foot towers, and will be of considerable importance in increasing the facilities of Fort Caswell, near the coast, which at present has only one light having a 36-in. dial. The new lights will also serve to guide mariners clear of the dangerous Frying Pan shoals on the Atlantic coast some miles from Fort Caswell.

HIGH-VOLTAGE DIRECT-CURRENT SYSTEM.—At a meeting of the Electrical Section of the Canadian Society of Civil Engineers, held on Dec. 9, Mr. A. H. Barringer presented a paper descriptive of a 2750-volt, direct-current generating and distributing system that has been in service at Twickenham, England, for the past five years. Use is made of two 200-kw, 2750-volt generators, which supply energy to direct-current rotary converters, having double-wound armatures, which deliver direct-current at 550 volts. The system as a whole is operated satisfactorily; the greatest trouble has been in the low-tension distributing cables.

DEEP WATERWAYS AND SUBWAYS MAY BE CONSIDERED BY ILLINOIS LEGISLATURE.—In Governor Deneen's call for a special session of the Illinois Legislature, to be assembled on Dec. 14, he specified 24 subjects to which he directed the special attention of the law-making body. Among these are two of more particular interest to electrical men. These are the enactment of legislation concerning the construction of a deep waterway and development of water-power between Lockport and Utica, Ill., on the Illinois River, and a proposed law to authorize cities to construct, maintain and operate subways and to control and regulate their use. The latter suggestion refers to the projected subways in Chicago.

N. E. L. A. MEMBERSHIP.—The membership of the National Electric Light Association has grown lately with most gratifying rapidity, and last week crossed the 4000 line. The increase in the last two months has been nearly 500, and the gain since July is about 1000. The Membership Committee, under Chairman H. H. Scott, has attacked its task with irresistible vigor and enthusiasm, and there is every indication that a total of 5000 members is not far off. A hopeful feature of the growth has been the steady accession of operating companies, and upon them the energies of the membership campaign are particularly concentrated. In fact, in view of the usefulness of the Association to member companies, and its value to literature, it is hard to understand why any central station should not enjoy all the benefits thus available.

WISCONSIN ELECTRIC RAILWAY TAXES.—All the street railway companies operating in Wisconsin have paid their taxes for the year, amounting to $422,015.21. Of this amount 15 per cent goes to the State and the remainder to the cities, towns and villages in which the property taxed is located. The principal payments were as follows: Milwaukee Electric Railway & Light Company, $249,763.87; Milwaukee Light, Heat & Traction Company, $62,869.62; Milwaukee Northern Railway Company, $18,175.04; Duluth Street Railway Company, $8,858.90; Chippewa Valley Railway, Light & Power Company, $8,858.90; Green Bay Traction Company, $8,287.36; La Crosse City Railway Company, $5,143.88; Sheboygan Light, Power & Railway Company, $7,315.74; Wisconsin Traction, Light, Heat & Power Company, $10,744.99; Wisconsin Electric Railway Company, $7,430.05; Wausau Street Railway Company, $21,868.25; Rockford & Interurban Railway Company, $3,372.10.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY ANNUAL REPORT.—President Richard C. Maclaurin, of the Massachusetts Institute of Technology, in his first annual report to the trustees urges the necessity of further endowment, and states that the present grant of $25,000 per year is absurdly inadequate, being less than 5 per cent of the total operating expenses of the institute. The need of a new location is also emphasized in the report, which states that the present site is conveniently situated, but noisy, dirty and subject to electrical and mechanical disturbances which interfere with its efficiency as an educational machine. The present buildings are also overcrowded and scattered. A new site of 25 acres is desired as near the center of Boston as is feasible, and with a provision for dormitories for many of the students whose present lodging conditions are not of the best. President Maclaurin suggests in conclusion that when the opportunity arises the institute should sell all its unrestricted property, secure a new site, and then, so far as necessary, throw upon the public the burden of erecting new buildings and installing new equipment.

N. E. L. A. GAS ENGINE COMMITTEE.—A preliminary meeting of the N. E. L. A. Gas Engine Committee was recently held, at which President Frueauff by letter suggested an outline of work, including securing data on the operation of isolated installations of gas engines, running either on city gas or on producer gas, which compete with central stations. In order to get this information promptly, and to divide the burden of the work between the various members of the committee, it was decided that each member of the committee should take personal charge of collecting data within a certain territory. It was also decided that the chairman should communicate with the manufacturers of gas engines and producers asking them to advise the committee what changes or improvements had been made in their apparatus since last described in a N. E. L. A. report. Mr. Klumpp, the consulting engineer of the committee, was delegated to obtain what information he could about the operation of the Gary blast-furnace gas-engine plant, and at a later date it may be desirable for the committee to visit the plant in a body.

SOUTH CAROLINA WATER-POWERS.—According to a recent report to the State Government, the textile mills of South Carolina now employ 45,478 hydroelectric horse-power, 16,375 electric horse-power generated by steam, 26,235 water horse-power and 76,734 steam horse-power.

MANCHESTER, ENGLAND, MOTOR SERVICE.—The municipal plant of Manchester, England, rents motors at prices ranging from $12 per annum for a ½-hp machine to $127 for a 50-hp machine. Consumers can also purchase motors on monthly payments extending over three years.

NEW NORWEGIAN ELECTRIC SMELTING WORKS.—A second works for the reduction of iron ore by the electric furnace method are to be erected by H. Boholm, director of the Cobber Mine & Smelter Company, of Trondhjem, Norway, one of the best-known metal concerns in Norway.

THE NOBEL PRIZES.—As previously noted, Marconi is among those to whom Nobel prizes were awarded this year. The prize for physics was divided between Marconi and Prof. Ferdinand Braun, of the University of Strasburg. Prof. William Ostwald received the prize in chemistry. The value of each prize is $40,000.

MONTREAL MUNICIPAL PLANT.—An election will be held in Montreal on Dec. 21 to vote upon a by-law passed by the Council involving an expenditure of $2,000,000 for a municipal lighting plant. The Legislature has already granted the city the right to borrow the money, provided that the plan is approved by a vote of the real estate owners.

CARBON-SILICON DYNAMO BRUSHES.—A patent issued Dec. 7 to Georg Egly, of Berlin, Germany, describes a dynamo brush consisting of carbon with an admixture of from 2 to 5 per cent of silicon. It is claimed that this type of brush has a sliding contact of excellent conductivity, is of great hardness, and gives a good polish to the commutator.

DENVER ELECTRICAL CLUB.—An electrical club for social purposes and for forwarding the general interests of electrical men has been formed in Denver with an executive committee made up of Messrs. G. A. Woolley, of the General Electric Company, and L. M. Cargo, of the Westinghouse Electric & Manufacturing Company, and Mr. Hall, of the Nernst Company.

ELECTRIC CLUB AT "DUTCH LUNCH."—An agreeable diversion from the usual program of technical discussions was afforded by the regular weekly meeting of the Electric Club of Chicago on Dec. 8, which took the form of a "Dutch Lunch." There were story-telling and informal speeches, and it was voted that a luncheon of this description should be held monthly hereafter.

MONEY BY CABLE FROM ENGLAND.—The British Post Office Department has made an arrangement with the Western Union Telegraph Company to make cable transfers of money between its offices in the United States and points in Great Britain and Ireland, where the orders will be cashed through the postal department. The arrangement will become operative on Jan. 1 next.

LONDON ELECTRICAL SUPPLY.—A new measure will be brought before the British Parliament having for its object to transfer to the London City Council the right, at present vested in the Borough Councils, to purchase the plants of five electrical supply companies. A previous act transferred to the Council the power to purchase the plants of a number of electrical supply companies, and the object of the proposed measure is to extend the power of purchase to the remaining companies of London, in order to place the Council in a position to take over by the year 1931 all of the electrical supply of the metropolitan district.

JOVIAN HEADQUARTERS IN CHICAGO.—The national headquarters of the Sons of Jove have been removed from Dallas, Tex., to Chicago, where a permanent office has been secured in the Monadnock Building. Mr. R. M. Van Vleet, the Mercury of the organization, and Mr. E. D. Strickland, assistant to Jupiter, are in charge of the office. The members of the organization are invited to send their mail or telegrams to the Chicago headquarters or make any other use of the office. Mr. F. P. Vose, of Chicago, is statesman-at-large for the Sons of Jove, and Mr. W. S. Taussig is statesman for Illinois.

THE WELSBACH TUNGSTEN LAMP.—A suit has been instituted by the English firm handling the Osram tungsten lamp against the Welsbach Incandescent Gas-Light Company, which recently, as noted in these columns, introduced a tungsten lamp that is offered to electric light users, payment to be on the basis of saving in electric light bills. The advertisements were ambiguous as to the origin of the lamp, and the plaintiff maintains that the wording indicates an infringement of its sole rights in Great Britain to the Osram lamp. There have already been a number of hearings in the suit, but the mystery surrounding the gas company's tungsten lamp has not yet been penetrated.

RAILROADS INTERESTED IN CONSERVATION OF FUEL.—In former issues the aims and methods of the International Railway Fuel Association were described. Recent conferences on the subject have been held at Washington by Mr. Emerson, chairman of the conservation committee of the International Railway Fuel Association; Mr. Pinchot, Government forester, and Dr. J. A. Holmes, expert in charge of the technological branch of the Geological Survey. The subject has been discussed by the joint committee on conservation in the Government departments at Washington, which also forms a sort of clearing house for the State conservation commissions.

PROPOSED MONTREAL ELECTRICALLY OPERATED TUNNEL.—There is a probability of the Canadian Pacific Railway Company constructing a tunnel under Montreal for the purpose of connecting its two stations, the trains to be operated by means of electricity. Plans for extensions to both stations are under way. While the distance between Windsor Street and the Place Viger is only a mile and a quarter, the trains having to make this journey must traverse no fewer than 18 miles of tracks, which long detour means a large added expense in the haulage of freight. It is thought that the tunnel would in the long run prove a great economy, and at any rate it is admitted that it forms the most feasible solution of the serious problem of transportation from one station to another.

AMERICAN BELL CANNOT DO TELEPHONE BUSINESS IN MICHIGAN.—The Supreme Court of Michigan has rendered a decision refusing to grant permission to the American Telephone & Telegraph Company to use its lines for telegraphy. The court stated that for more than a quarter of a century the Legislature has seen fit to keep separate these two lines of activity, which course has been followed, too, during a period in which the telephone business of the State has grown from an insignificant enterprise to one of great magnitude. "Wherever the telegraph line is, there, too, is the telephone. In the hands of the Independent agencies it may well be that a healthy competition for the transmission of information by electricity will ensue. We are of the opinion that the legislative enactments touching the question indicate a policy on the part of the State to afford its people a choice of two agencies of independent ownership."

Generating and Transmitting Equipments of the Tokyo Electric Light Company.

THE Tokyo Electric Light Company was established in 1883 with a capital of 200,000 yen (about $100,000). Since then, by process of either buying over or amalgamating with other companies, thereby necessarily augmenting its capital, it steadily increased in importance, until it became, in June, 1906, a concern with a capital of $3,575,000, having a generating equipment of 11,000 kw and also a monopoly of the electric lighting business for the entire city of Tokyo and suburbs. Previous to this, in 1904, the company decided to engage in hydroelectric development, and in pursuance of investigations carried out at that time and in execution of rights already secured in 1899 in making use of the River Katsura, in Yamanashi Prefecture, various preparatory measures, such as actual surveying, buying up land, etc., were completed in 1895. The work of construction for the new power plant was started in January, 1906, and was finished in February, 1908. As a result a total amount of power corresponding to 25,500 brake hp at the turbine shafts was obtained, and the company was enabled to discontinue entirely the use of its former steam plants. For 11,372 ft. the water runs in open canals. The gradient of the water course is 1 in 1200 in the tunnels and 1 in 2400 in the open canals, the difference of water levels between the intake and the penstock chamber being 13 ft. 9 in.

The machines installed in the generating station consist of double Francis turbines directly coupled with three-phase generators. The turbines are of the double-reaction type, each being capable of giving 4500 brake hp at 500 r.p.m. The generators are of three-phase, revolving-field type, each having a rating of 3900 kva at 6600 volts. The generating station contains six sets of these turbines and generators and two sets of exciters, also directly coupled with Pelton waterwheels, each rated at 265 brake hp at 600 r.p.m. Each exciter-generator has a rating of 180 kw. In addition, there are nine 2000-kw, single-phase step-up transformers.

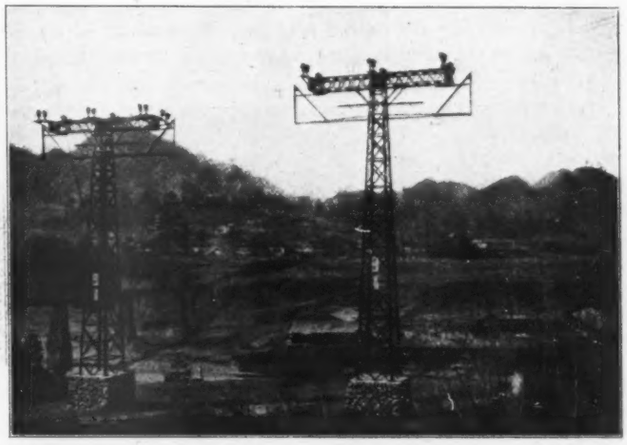


FIG. 2.—STEEL TRANSMISSION TOWERS.

At the Waseda receiving station nine 1800-kw step-down transformers are installed. Between the Komahashi generating station and the Waseda receiving station the energy is transmitted through a duplicate system of overhead lines supported by 4100 poles, the distance being 47 miles. Each of the six conductors is a bare cable 105 mils in diameter, consisting of 18 strands of copper.

On account of the rapidly increasing demand for electric lighting the company has found even its present large hydro-

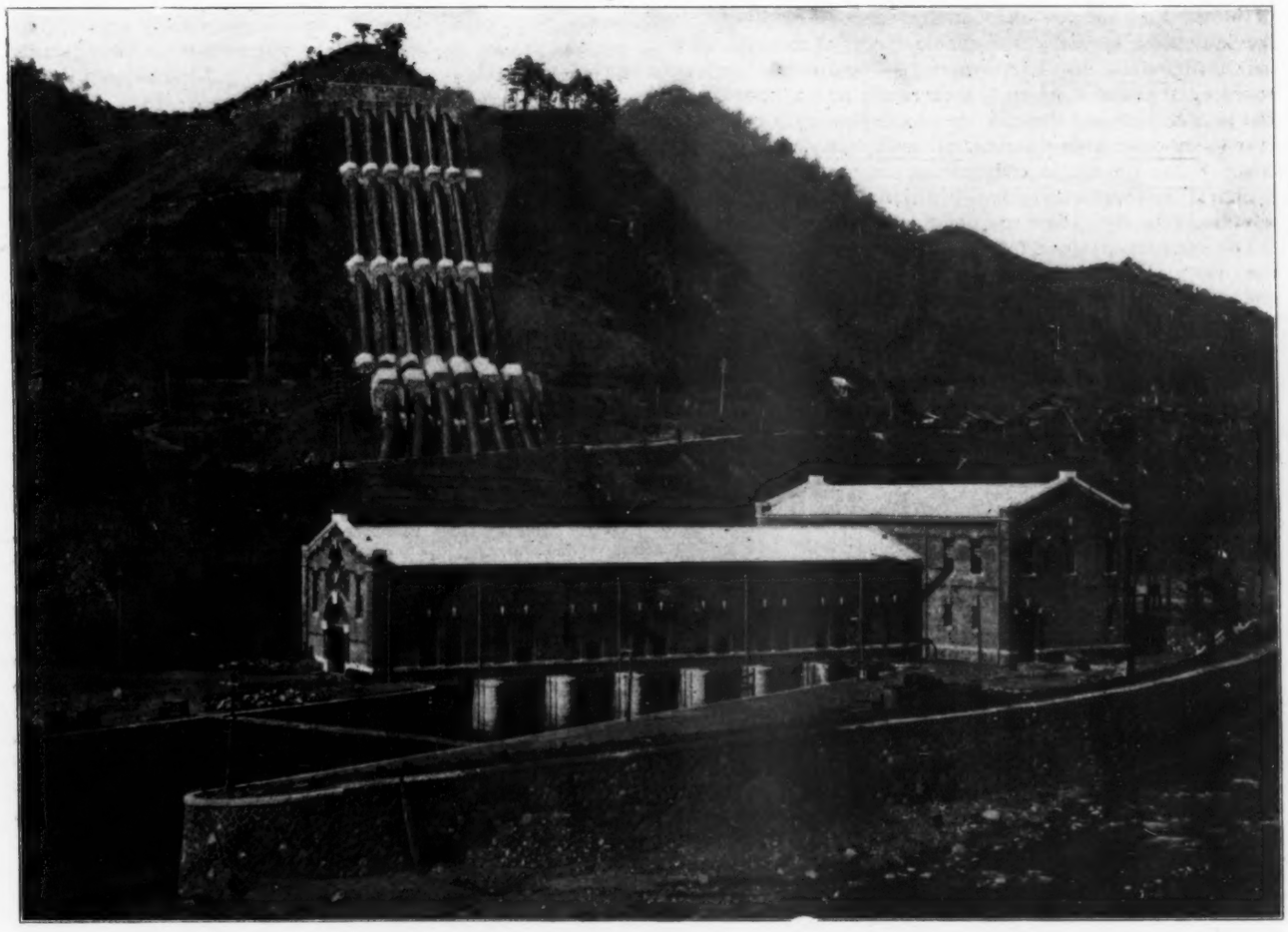


FIG. 1.—GENERAL VIEW OF POWER HOUSE SHOWING PENSTOCKS.

electric plant insufficient to meet requirements, and it has been decided to secure a second source for hydroelectric power. In the meantime, as the load gradually increases recourse will be made to the old steam plant, which is always kept in order as a reserve.

The River Katsura, from which the company obtains its power supply, has its source in Lake Yamanaka, which in turn is fed by subterranean streams that drain through the sides

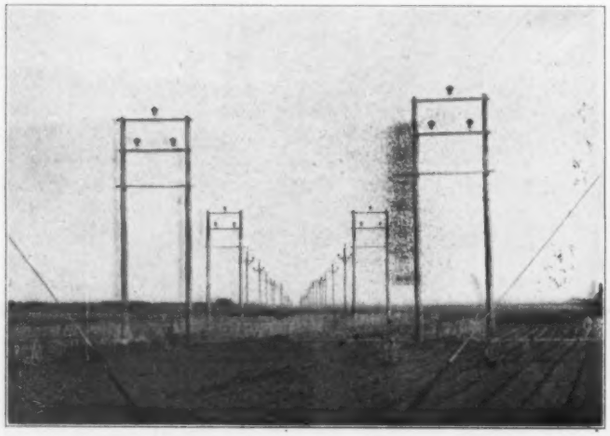


FIG. 3.—WOODEN POLE TRANSMISSION LINES.

of Mount Fuji and the surrounding ranges. The altitude and humidity being favorable, there is no danger at any time of the lake getting dried up. Furthermore, the land immediately surrounding the lake is of such a character that all flood water can be absorbed, and there is, therefore, no danger of the lake ever overflowing even after exceptionally heavy rainfalls. The River Katsura may, in consequence, be said to possess two qualifications necessary for hydroelectric purposes, namely, unfailing supply of water and non-fluctuation in flow.

The company has one intake and one generating station on the river. The quantity of water utilized is 750 cu. ft. per second, producing 22,500 hp at the turbine shafts at an effective head of 345 ft. Three-phase generators having a total rating of 15,000 kw and directly coupled to the turbine shafts produce electricity at an e.m.f. of 6000 volts. The pressure is stepped up

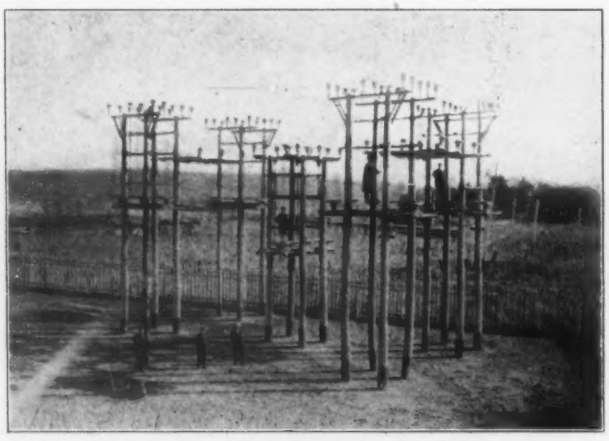


FIG. 4.—OPEN-AIR DISCONNECTING SWITCHES.

to 57,000 volts for transmission to Waseda receiving station, 47 miles distant from the generating station. At the receiving station the pressure is reduced to 11,000 volts, at which e.m.f. energy is distributed to the city substations by means of underground cables.

The length of water course between the intake and the penstock chamber at Komahashi is 22,229 ft. The water course contains nine tunnels, the longest of which is 3114 ft. The aggregate length of all the tunnels is 10,857 ft., and for the remaining distance of stand-by. In consequence of this condition the company has amalgamated with the Tokyo Electric Power Company, thus further securing water rights. The additional work will require three years for completion, and the result is expected to yield an additional 50,000 brake hp.

The total cost of construction of the 22,500-hp installation now in service was about $2,925,000, or about $130 per horse-

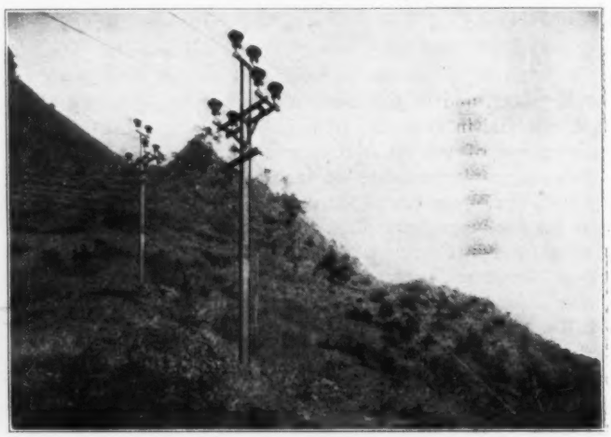


FIG. 5.—TRANSMISSION POLES ON MOUNTAIN SIDE.

power. The capital stock of the company at the present time is about $12,000,000, of which about $9,000,000 has been paid up. The president of the board of directors is Mr. Sakutaro Satake, and the general manager of the company is Mr. Unai Mochizuki.

The Power Plant of the Harvard Medical School.

THE lately completed buildings of the new Harvard Medical School, in the Fenway district of Boston, form one of the most imposing architectural groups in America. This department of the university is probably the most completely equipped school of medicine in the world at the present time, and its plant has attracted wide attention during the past two or three years. Representing an investment of over $3,000,000, the present buildings form the nucleus of a group destined to become essentially a university of medical instruction and research. The buildings are located at the head of the magnificent Avenue Louis Pasteur, now under construction through the Fenway, and surround a court of imposing dimensions. The buildings are of white marble, and occupy about two acres, the total area of the present site being about 30 acres. At the head of the court is located the Administration Building, and on each side are laboratory buildings constructed in such a way that each wing is composed of unit laboratories of flexible relations, with a central lecture-room in the main body of the building. In the accompanying general plan of the property, the buildings are designated as follows: Building A, Administration; Building B, Anatomy-Histology; Building C, Bacteriology-Pathology; Building D, Pharmacology-Hygiene. The architects were Messrs. Shepley, Rutan & Coolidge, of Boston.

The engineering services required by the school include power, heating, lighting, ventilation, refrigerating, water and compressed-air supplies, with various communicating equipment in connection with the temperature regulation and the usual telephone and bell requirements of a large institution. The power plant is one of the most complete in existence for institutional service. It, with the entire mechanical equipment of the institution, was designed by the engineering firm of Densmore & Le Clear, Boston.

The power house is located on Vila Street, about 650 ft. away from the nearest laboratory building, and it is connected

with the school by a service tunnel carrying all the supplies of energy generated at the plant. The plant is a brick and steel structure with concrete foundations, about 138 ft. long by 115 ft. wide. It was located at this distance from the school buildings in order to avoid encroaching upon the space to be occupied by future hospitals. The side of the power house facing the school is not provided with windows. The engine-room occupies the entire front of the power house, side windows and

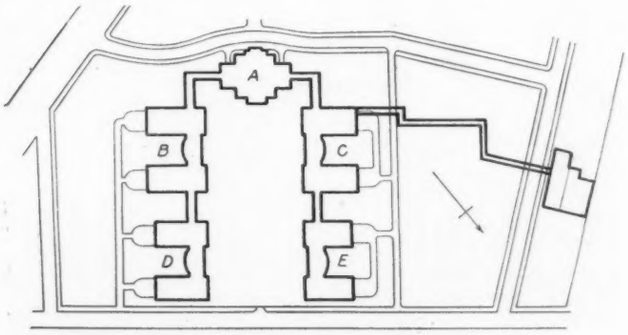


FIG. 1.—ARRANGEMENT OF BUILDINGS OF HARVARD MEDICAL SCHOOL.

a large skylight being provided. At the rear of the power-plant building is located the boiler-room, this arrangement being used to avoid noise and dirt in connection with coal handling on the side toward the future hospitals. The power house at present contains 954 hp in boilers, 725 kw in electric generating apparatus, a motor-driven and steam-operated refrigerating plant, live-steam and exhaust-steam heaters, air compressor and pumps of various types. A commodious basement, coal pocket, pumproom, office for the chief engineer and lavatory are provided. Both natural and forced draft is available, a brick stack being installed for the former service. The stack is 175 ft. high and 10 ft. inside diameter.

The boiler-room at present contains three units, space being reserved for a fourth without alteration of the room. Eight boilers can be installed by removing the present coal pocket. In such an event a new coal pocket could be installed at the south end of the boiler-room on the outside of the building. The boiler-room is about 86 ft. long, 47 ft. wide and 39 ft. high. The boiler-room has no basement, but an air tunnel for forced-draft service is carried beneath the floor. The present boiler installation consists of three 318-hp Stirling units, each having 3000 sq. ft. of heating surface and 285 3.25-in. tubes. The steam outlets are 7 in. in diameter. Each boiler has two shaking grates having a total area of 64 sq. ft. Two units are set in a single battery and the third in a half-battery. On account of the presence of the heating equipment, which is supported above the boilers, the center wall was made 12 in. thicker than usual so as to accommodate the necessary columns. Each boiler is built for a working pressure of 150 lb. per square inch, and when running at, or about, its rating with a $\frac{5}{8}$-in. draft at the smoke connection, is guaranteed to utilize 75 per cent of the heating value of any freshly mined run-of-mine New River, Pocahontas or West Virginia coal. The steam is guaranteed to contain not over 1 per cent of moisture at full load, and 1.5 per cent at 30 per cent overload.

At the rear of the boilers is installed a smoke flue 42 in. x 48 in. in section at the beginning and increasing to a 60-in. x 120-in. section at the end of the batteries. The flue forms at the end of its run one leg of a "Y" which discharges the gases into a breeching 13 ft. high and 7 ft. wide, leading into the stack. When future boilers are installed the "Y" can be used to carry off their products of combustion. The flue is built of steel plates 0.25 in. thick, and is supported on I-beams at the larger end. On the outside of the flue, at the clean-out hole, is attached a collar to which may be fastened a canvas bag 18 in. in diameter while the flue is being cleaned. Dixon graphite paint was applied to both the inside and outside of the flue to prevent rust. Magnesia blocks covered with plastic cement were installed on top of the flue. The draft is controlled by two Spencer automatic regulators, one operating the main flue dampers and the other the throttle valve on the engine driving the forced-draft fan. The fan is a Sturtevant three-quarter housed wheel 42 in. in diameter and 6 in. wide, directly driven by a steam engine. The fan discharges into a 6-ft. x 5-ft. duct connected with the boiler furnaces. Inferior grades of coal can be burned by using the fan system.

Coal is delivered to the plant by wagons, which are drawn up an inclined approach, the fuel being dumped into the pocket by gravity. The holding capacity of the pocket is 500 tons. A bin for the temporary storage of ashes is located above the ground level, so that a wagon can be backed under it to receive the ash products. These are elevated above the boiler-room floor by a 1-ton hydraulic hoist and thence discharged into the bin. All the fuel used is weighed on a set of Howe scales having a 1000-lb. range exclusive of the hand-car weight. Three Hunt cars, each of 1000-lb. haulage capacity, are in service between the coal pocket and the furnaces, and arranged so that either side can be dropped for feeding coal to the boilers on each side of a center aisle. The boilers are fired by hand.

The medical school buildings are heated by hot water, and there are installed in the boiler-room for this service, and above the boilers, two live-steam and two exhaust-steam heaters. Room is left in the installation for two additional heaters of each type.

The feed pumps and several other auxiliaries of the plant are located in a special pump-room at the level of the boiler-room floor, 24 ft. long by 21 ft. wide. There are three Blake duplex inside-packed units; two of these have 9-in. x 5.25-in. x 10-in. cylinders, and the third 6-in. x 4-in. x 6-in. cylinders. The pumps were selected for the duty of feeding 2700 boiler hp, allowing for future equipment. The two larger pumps are lagged with Keasby & Mattison magnesia covered with Russia iron. The feed-water heater is a Whitlock outfit rated at 2500 hp. It contains 833 sq. ft. of heating surface and has 18-in. steam outlets.

The furnaces of the boiler plant are designed to burn soft coal mixed with enough screenings to avoid smoke, the forced draft being used as necessary. A 28-in. fire wall separates the boiler-room from the engine-room.

The engine-room is 134 ft. long by 43 ft. wide, and it is spanned by a transverse gallery separating the electric generating from the refrigerating and water-circulatory equipment. At a central point, and at one end of the gallery, is located the

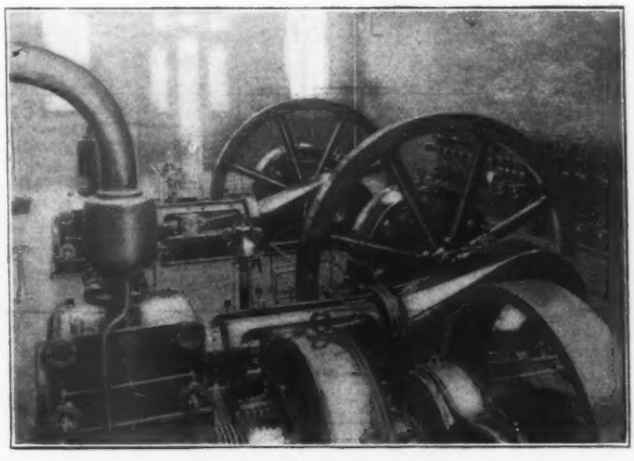


FIG. 2.—ENGINE-ROOM.

office of the chief engineer. A 10-ton hand-operated Reading crane spans the engine-room and serves its entire length. The electric generating units consist of one 125-kw Westinghouse generator directly driven by an American-Ball duplex compound engine, and two 300-kw Westinghouse generators directly driven by single-cylinder, non-condensing Brown-Corliss engines. The guaranteed efficiencies and water rates of the units are as follows:

Per cent load	125	100	75	50
Lbs. per hp-hour, 300-kw, non-condensing set	27.75	27	28	30
Efficiency of generator, per cent	....	92.5	91	86
Lbs. per hp-hour, 125-kw, non-condensing compound set	26	23	25	30
Efficiency of generator, per cent	91.5	92	91	86

The advantages of compound operation at full load are significant, although in this plant the use of the exhaust steam in the heating of the circulating water for the school buildings rendered the selection of simple non-condensing engines desirable for the heavier service of the installation. Cochrane separators are used on all of the units. Each generator is of the three-wire, direct-current type, giving 115 volts and 230 volts. The guaranteed speed regulation of the larger units is 2.75 per cent between no-load and 25 per cent overload, and of the smaller set, 1.5 per cent for sudden changes in load up to the foregoing limit.

From the generators cables carried in floor ducts lead to a 14-panel switchboard of Monson slate, the total length of the board being about 33 ft. There are three generator panels, one totalizing, one instrumental panel for motor and lamp service voltmeter indications, two lamp and two motor panels for the school buildings, two power-house lighting and motor service panels, two circulating motor panels, and a distribution panel for the Carnegie Institution Laboratory of Nutrition, located near the school. The Good Samaritan Hospital is also supplied with electricity by the school equipment. Weston indicating instruments, General Electric recording voltmeters, Bristol and Thomson watt-hour meters are installed on the board. The total output of the generators is measured by a 4000-amp ammeter and watt-hour meter; the totalizing panel also contains an indicating wattmeter of 1000-kw rating. Voltmeters are provided to show the potentials existing at important distribution centers in each of the school buildings. The lamp and motor loads in all of the buildings are measured by suitable indicating and recording equipment, so that the consumption of all divisions of the school can be determined with ease. A special feature is the installation of a small switchboard and thermophone system in the office of the chief engineer, which shows the temperature at different points in the distant buildings by electrical indicator connections. The power house is lighted by 110-volt, 5-amp enclosed-arc lamps of the General Electric Company's manufacture.

The hot-water supply for the buildings' heating system is forced through the piping by circulating pumps located in the

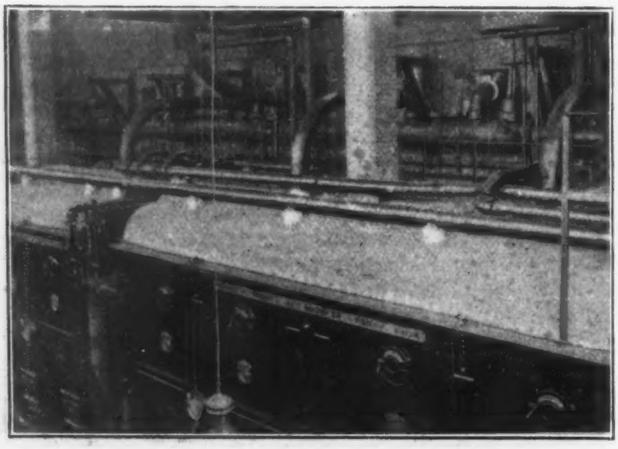


FIG. 3.—BOILERS AND PIPING OF POWER PLANT.

engine-room. Two pumps are installed, each capable of delivering 5000 gal. per minute against a pressure of 31 lb. per square inch at 550 r.p.m. Each unit consists of a single-stage Morris centrifugal pump directly driven on a horizontal shaft by a direct-current, 230-volt Thompson-Ryan motor, built by the Ridgway Dynamo & Engine Company, of Ridgway, Pa. Either pump is of sufficient size to handle the entire work; only one pump is run at a time, as the operation of two pumps in parallel does not increase the pressure. The only head against which the pumps operate is the friction head. The maximum efficiency of each pump is attained at an output of 4000 gal. per minute. Each pump is capable of sustaining a static pressure of 150 lb. per square inch. The motors are designed for variable speed control by field regulation between 275 r.p.m. and 550 r.p.m., and have an overload range of 25 per cent for 24 hours' run with a maximum temperature rise of 50 deg. C. above the

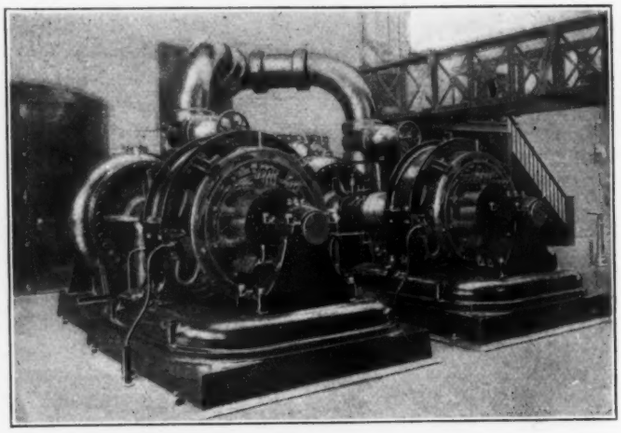


FIG. 4.—MOTOR-DRIVEN HOT-WATER PUMPS FOR HEATING BUILDINGS.

surrounding air. The commercial efficiency guarantee of each motor runs from 90 per cent at full-load to 86 per cent at half-load and 81 per cent at quarter-load.

Compressed air is supplied to the different buildings by a simple duplex Blake steam-driven compressor able to deliver 104 cu. ft. of air per minute at 50 lb. per square inch, with steam at 110 lb. pressure and a speed of 150 r.p.m., the indicated cylinder performance being 13.5 hp. The air cylinders are water-jacketed, and the suction pipe protected at its entrance by a wire screen. Air lines are extended to the different generators and motors to facilitate cleaning, the connections being made to a basement air receiver by 0.5-in. pipes. The compressor discharges into the receiver by a 3-in. line. The holding capacity of the tank is 63 cu. ft.

The exhaust steam from all the engines is used for heating the circulating water for the school buildings, in heaters located above the boilers. All of the steam pumps also discharge into this system. In case the supply of exhaust steam becomes inadequate, high-pressure steam can be turned into the heaters. The exhaust and live-steam heaters are separated so as to enable the condensation from the latter to be returned to the boilers. No pumps or traps are required for this service. A Venturi meter is installed in the station so that the water used in the heating system of the buildings can be readily observed. The two live-steam heaters are of Whitlock make, 42 in. in diameter and about 11.5 ft. high. Each has 10-in. water connections, a 6-in. steam supply and a 4-in. drip. The two large exhaust-steam heaters in the boiler-room were built by the York Manufacturing Company, of York, Pa. In each the steam circulates through vertical tubes surrounded by water. Each heater is 17 ft. high and 5 ft. in diameter; has 10-in. and 6-in. steam and water connections, and is piped so that either series or parallel operation can be had. Service hot water for the lavatories, etc., is supplied by a 100-gal. live-steam heater and by a 300-hp exhaust-steam heater of Whitlock make. Both of these are located in the pump-room, and their design insures operating at the maximum efficiency, as is true in the case of the larger heaters. A small motor-driven pump is installed to maintain the circulation in the service water-pipe lines.

The refrigerating apparatus was installed by the Carbondale Machine Company, of Carbondale, Pa.; it is capable of cooling 250 gal. of brine per minute from 5 deg. Fahr. to 0 deg. Fahr., or of producing 50 tons of ice in 24 hours. The equipment is of the absorption type, and receives cooling water from an

artesian well 315 ft. deep. Calcium chloride brine is used. This apparatus is in the main steam-driven, although a brine pump is provided of the motor-driven centrifugal type, the motor being designed for 25 per cent speed control through field variation. A complete system for metering the brine is installed. The brine mains are 5 in. in diameter for both supply and return lines, and are carried to the school buildings through the power-house service tunnel. The mains are supported by galvanized-iron pipe straps fastened to an outside covering of sectional cork put on in two layers with all joints broken. The straps are hung from cast-iron brackets attached to the wall of the tunnel, and have a minimum width of 8 in. The brackets are 8 ft. apart and are staggered on the supply and return mains to prevent the hangers passing through the insulation. Mains run in trenches in the power house are supported on heavy cyanized wooden cradles. Only one brine pump is used at a time. A storage tank in the power-plant basement makes it possible to run the brine circulating pumps and do a considerable amount of cooling after the refrigerating equipment proper has been shut down. Hohmann and Maurer thermometers are used. All this piping is of wrought iron tested for 100-lb. pressure. At certain points in the tunnel tees were left for the supply of brine to future buildings.

Steam ejectors are provided in the boiler-room for the blow-off and ash-hoist pit, and a Blake bilge pump is installed for clearing the forced-draft air duct of water. The boiler-feed water is measured by a Worthington duplex-piston meter, equipped with a by-pass. The water of condensation from the live-steam piping and separators is returned to the boilers by the Holly loop system, an 11-ft. x 4-ft. receiving tank being installed. Kieley traps are used on the live-steam service water heater, the steam cylinders of the air compressor, pump-exhaust main, hospital service steam main and the power-plant heating system. Foskett and Bishop traps are used at the high points of the hot-water heating and service systems. All traps and reducing valves are by-passed, and thermometers are liberally installed on all piping systems.

A central oiling system is installed for distributing lubrication to the machinery in the power house. A pure-oil reservoir of 65-gal. capacity is located in the pumproom about 8 ft. above the engine-room floor level, and from this a 1.5-in. line supplies oil to the engines and motors through suitable taps. From the machines the oil is piped into a White Star filter in the basement, having a daily output of 150 gal. and a storage capacity of 60 gal. Connected with the filters are two storage tanks which are used alternately, each of 120 gal. capacity. A noteworthy feature of the oiling system is the use of city water pressure instead of a pump or compressor. The plan was developed by Mr. H. A. Stevens, chief engineer of the institution.

The steam piping in the power house is flexible without being unduly complex. From each boiler a 7-in. supply pipe rises to the main header, 15-in. diameter, running practically the whole length of the room behind the boilers. Van Stone joints are used in the header. From it are taken the branches for the engines and pumps. The two 300-kw units are served by 8-in. lines which are provided with valves on the boiler-room side of the wall, as well as between the separators and the high-pressure cylinders. From one end of the header an 8-in. line drops to the basement and traverses the space beneath the engine-room floor in a loop which joins the main header again by a riser at the opposite end of the boiler-room. From this 8-in. line a 5-in. supply pipe leads to the 125-kw generating unit and a 6-in. lead in the basement supplies the air compressor, laboratory steam line and steam-heating service for the Good Samaritan Hospital. Laboratories are served by a 4-in. main through the tunnel, a tap being taken off for radiators used in the heating of the power house. At the end of the 8-in. loop next to the pumproom a 3-in. live-steam supply main for the boiler-feed and bilge pumps is taken off, this line being extended past the pumps and back through the boiler-room to the outside of the fan-engine compartment, where a 5-in. line connects it with the opposite end of the main steam header. A 2-in. tap supplies steam to the fan engine. These loops insure continuous service in case of trouble. The Good Samaritan Hospital is heated by steam.

The live-steam heaters are supplied by an 8-in. loop which enables either or both of them to be fed from the main steam header by either or both batteries of boilers. The live-steam service water heater is fed from the pump supply line. Van Stone joints are used on all live-steam piping. The condensation of the live-steam heaters is carried back into the boilers through check valves.

The exhaust piping is flexible in arrangement. The larger engines discharge into a 16-in. main in the basement, this line expanding to a diameter of 18 in. for collection of the exhausts from the smaller engine and other steam-using machinery. The usual feed-water heater connections are made, a by-pass being placed around the heater. The exhaust-steam water heaters for the school service are supplied from the trunk exhaust line. The piping for the hot-water heating service begins at the motor-driven centrifugal pumps in the engine-room. Two 12-in. pipes expand into 14-in. lines, one from each pump, and these form a "Y" whose common leg, 16 in. in diameter, connects with the heaters above the boilers. The outlet of each heater connects with a second 16-in. line parallel to the first, and cross-connections of this size are provided between the different mains and heaters. The valve connections provide for passing the water through the heaters either in series or parallel, and any heater can be cut out of service without interfering with the flow of water. From the boiler-room the hot-water line passes through a 16-in. Venturi meter to the tunnel leading to the school buildings. The return connection to the centrifugal pumps is by a 14-in. line. The feed-water piping is arranged on a closed circuit, with a 4-in. supplementary city supply for the boilers. In the power house the brine piping is of the Byers wrought-iron type; the ammonia piping is of extra-heavy lap-welded wrought iron.

The service applications of the institution are too numerous to review here. They include the driving of all ventilating fans by directly connected motors; the use of small motors to operate shades in the lecture-room amphitheaters, vacuum service, acid-proof glass, distribution of electric mains and terminals throughout laboratories, centralization of lamp and motor panel boards in corridors, subdivision of laboratory illumination, operation of repair-shop tools by electricity, temperature regulation by the Johnson automatic electric system, distribution of time to 48 secondary clocks by a Standard Electric Time Company's master-clock system, private branch exchange service of the New England Telephone & Telegraph Company, use of electric lighting under microscopes; utilization of movable lecture-room tables, operation of electric elevator service provided by the Whittier Machine Company, of Boston; installation of emergency water showers in certain laboratories, and use of electrically operated projectors. A complete X-ray equipment is in service at the school.

The power-house piping was installed by the Walworth Manufacturing Company, of Boston. Pipe covering was furnished by the Nightingale & Childs Company, Boston, and the switchboard and power-plant wiring was handled by Edwin C. Lewis, of Boston. The Warren thermophone system is used. Mr. H. A. Stevens is the chief engineer.

Centrifugal Starting Arrangement for Single-Phase Motor.

A patent issued on Nov. 23 to Messrs. B. G. Lamme, R. S. Feicht and G. H. Garcelon deals with means for rendering a single-phase induction motor selfstarting under full-load torque. The rotor of the machine is arranged to revolve independently of the shaft during the starting period. The arrangement is such that the rotor starts from rest with the machine operating as a split-phase motor. As the speed increases a centrifugal device first opens the auxiliary starting circuit, then short-circuits the added starting resistance in the secondary circuit and finally clamps the rotor upon the shaft, thereby bringing the shaft with its load up to the full-load speed of the machine.

Factors Affecting the Design of Self-Excited, Single-Phase Shunt Induction Motors—II.

By Val. A. Fynn.

BEFORE dealing specifically with the design features of the single-phase shunt induction motor it seems well to investigate more closely the negative torque, the existence of which was discussed in the previous issue. For this purpose the variation of OF, and OD, that is, of t_{i2} and e_{r3} of Fig. 6 have been plotted in Fig. 10 against the actual speed n, together with N_3 and $v_1N^0_1$. Where N_3 varies proportionately with $e_{r1} - i_2w_2$ or with the speed, e_{r3} and consequently also OE or t_{i2} or i_{2v} vary as $n\ (1 - S^2)$. From the curves in Fig. 10 it is easy to

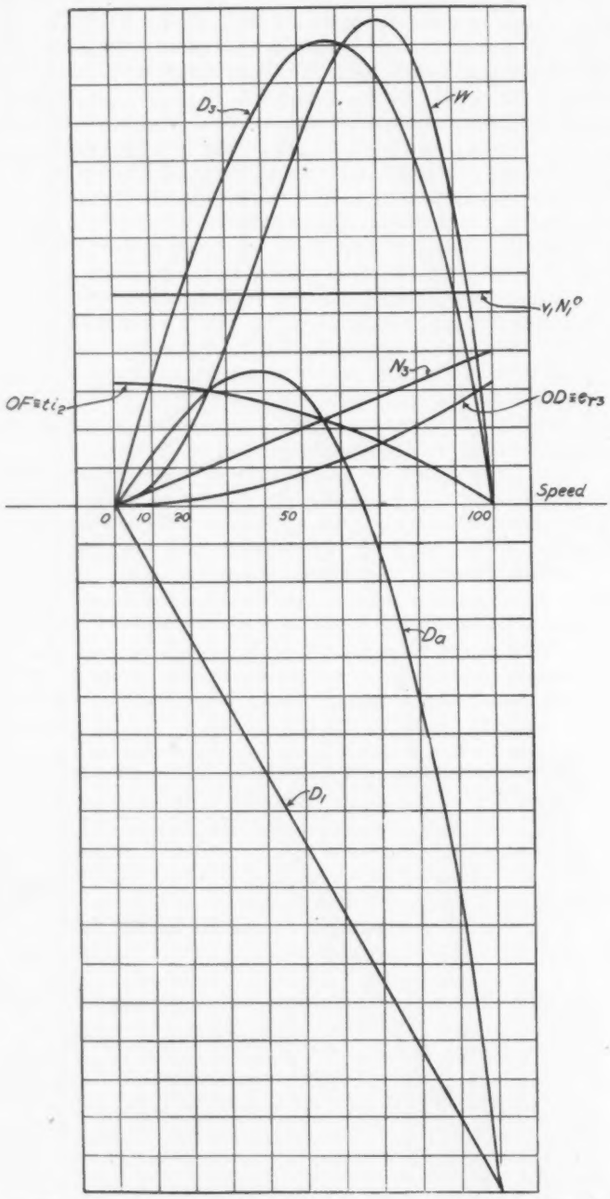


FIG. 10.—PERFORMANCE CURVES DERIVED FROM FIGS. 5 AND 6.

deduce the watts W available at any speed in the rotor and along the transformer axis. Thus $W = t_{i2} \times e_{r3}$, the main torque $D_3 = t_{i2} \times N_3$, the torque $D_1 = t_{i2} \times v_1N^0_1$ and finally the resultant torque $D_a = D_3 - D_1$. The deleterious effect of D_1 is well seen and it may be noted that this particular machine could not *run light* at more than about 65.5 per cent of the synchronous speed even if all its losses (D_1 excepted) were zero. It would require a large external torque to *drive* this motor up to synchronous speed and keep it at that speed. If Θ_3 is larger than zero, then D_1 is still further increased, for then OC leads OS and $< AOC$ becomes still smaller, as was shown in connection with Fig. 8.

It is known that the speed of a *polyphase* induction motor may be regulated within the widest limits by inserting ohmic resistance into the secondary; whereas these same means permit of only a very small variation in the case of a single-phase machine. The reason for this is clear from Fig. 10 and the trouble in the case of the single-phase machine is obviously due to the rapid increase of D_1 when w_3 is increased. Inserting resistance into the rotor of a single-phase induction motor, by means of slip rings, for instance, means that resistance is inserted not *only* into the armature circuit, as in the case of the polyphase machine, *but into the armature and into the field circuit.* It can be stated that:

Ohmic resistance in the motor field winding and iron losses along the motor field axis of the shunt-induction motor tend to reduce the magnitude of the motor field and to produce a negative torque.

Turning now to a practical shunt-induction motor—that is, to one having ohmic resistance, reactance and iron losses in the stator and rotor—the conditions are found to be rather more complicated. The complete diagram for such a motor at synchronous speed is shown in Fig. 11. The constants of the machine to which this diagram refers have been chosen as near to the values actually met with in practice as was compatible with clearness in the diagram; the constants are necessarily somewhat exaggerated. That is, $w_2 = 0.333$; $x_2 = 0.5$; $n = 1.00$; $\Theta_1 = \Theta_3 = 23.5°$. It has further been assumed that $v_1N^0_1$ remains constant; in other words, that $w_1 = x_1 = 0$. This assumption does not vitiate the following deductions and is very nearly true for the no-load conditions of a practical machine of this type. In the diagram of Fig. 11, $OA = e_{r1}$; $AJ = e_{r2}$; $BJ = -i_2w_2$; $MB = -i_2x_2$; $OT = N^0_3$; $TS = N_3'$; $OS = N_3$; $OD = QR = e_{r3}$; $OC = i_3$; $OK = t_{i3}$; $OF = t_{i2}$; $ON = -i_1w_2$; $NR = -i_2x_2$; $OG = i_0$; $GH = -i_2$; $OH = i$, and $OM = -e_3$.

Any current i_2 in the rotor along the transformer axis of such a motor will now lag behind the resultant impressed e.m.f (OR)

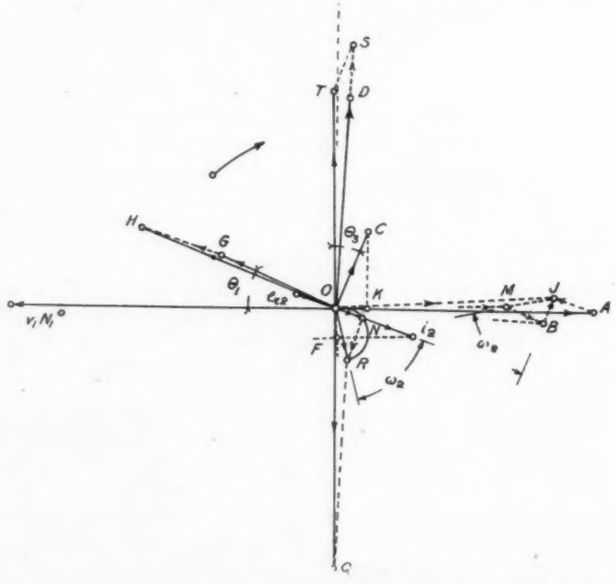


FIG. 11.—COMPLETE NO-LOAD PHASE DIAGRAM OF A COMMERCIAL SINGLE-PHASE INDUCTION MOTOR.

by a constant angle ω_2, the tangent of which is x_2/w_2 and is referred to as the time-constant of the rotor. Now x_2 is due to N_2' (the secondary leakage flux along the axis $a\,a$) and one must, therefore, take this flux into account. N_2' appears along the transformer axis, is cophasal with i_3 and has not been shown in any of the diagrams. It has been seen that e_{r1} opposed in phase to $v_1N^0_1$, is generated along the motor field axis by rotation in $v_1N^0_1$, which appears along the transformer axis; con-

versely then an e.m.f (e_{r_3}) will be generated along the motor field axis by rotation in N_2' and will be of opposite phase to N_2'. Thus two e.m.fs. will now be impressed on the rotor along the motor-field axis, instead of only one; they will add vectorially ($\overline{e_{r_1} + e_{r_2}} = OJ$) and their resultant OJ will be responsible for N_3. The field along the axis $b\,b$ will be proportional to OB only, and may be said to consist of two fluxes, $N^0_3 \equiv OM$ and $N_2' \equiv MB$, where $OM = e^0_3$ or the counter e.m.f due to N^0_3, and $MB = -i_2 x_2$ or the reactance voltage due to the rotor leakage flux N_2'. BJ represents the ohmic drop $i_2 w_2$. The back e.m.f. (e_{r_3}) along the transformer axis of the rotor is, of course, due to rotation in the *whole* of the field N_3 and is consequently in phase with $OS = N_3$. The main torque D_3 is only due to the component N^0_3 of N_3 and to the projection of i_2 on the prolongation of $N^0_3 = OT$.

Now, at synchronism OR will, as in Figs. 5, 6, 7 and 8, equal BA and lead the latter by 90 deg., but in this case, BA is not equal to $i_2 w_2$, nor is it equal to MJ, as might appear at first sight; it equals and opposes the vectorial sum $\overline{e_{r_2} + i_2 w_2}$. As has been previously stated i_2 will lag by ω_2 behind OR. At synchronism i_2 will be a little smaller than i_3 and lead the latter by a little less than 90 deg. Equality and quadrature relation is reached for $w_2 = 0$. The point of interest is that although the speed is synchronous, yet D_3 is not zero and is positive; at the same time, D_1 is not zero and negative, as was the case in Fig. 8. If, by some means, Θ_3 were to be made zero, while the time-constant of the rotor remained unchanged, then D_1 would be greatly reduced, for OK would become small, but D_3 would still be different from zero and still negative. At the same time D_3 would also become small while remaining positive. It is only when w_2 is made equal to zero as well that both torques become zero at synchronism.

Since i_2 and therefore N_2' lead i_3 by a trifle less than 90 deg., then D_2, although very small, for it can never be proportional to more than a fraction of N_2', will be positive at synchronism. One can say that:

A self-excited, partly or self-compensated, shunt-induction motor, the rotor of which is not devoid of reactance, ohmic resistance and iron losses cannot run at or above synchronism, even at no-load. The no-load rotor current in the transformer axis of such a motor will always be in excess of the rotor exciting current i_3.

It should be noted that the magnitude of i_3 depends for a given reluctance and winding on that of OM only. Now the larger N_2', therefore the larger $i_2 x_2$ or MB and e_{r_2} or AJ, also the smaller OM and consequently the smaller i_3. It has been shown that i_3 is in this motor reflected to a certain extent in the primary stator winding and is vectorially added to the primary magnetizing current, thus increasing the no-load current of the machine. From the above it will be seen that the greater x_2, the less will be the wattless component added to the primary magnetizing current at no-load. At the same time, the added watt component will also decrease just a little owing to the slight decrease of the losses enumerated at the outset (under 4 and 7). Thus:

The time-constant of the rotor directly affects the magnitude and the phase of the no-load current of a practical or commercial shunt-induction motor.

It follows that in designing such a motor the rotor resistance should always be chosen as small as possible. The rotor reactance can, however, be made comparatively large with impunity if care is taken to make the full-load speed very near the synchronous indeed by making w_2 extremely small. A large x_2 secures a reduction of the no-load current. The field winding should always be such as to make all the field ampere turns $i_2 z_2$ as effective as possible—in other words, the field winding should not be distributed over the whole of the pole pitch. The iron losses along the motor field axis should be kept small.

It remains to consider *the fully or artificially compensated* shunt-induction motor, such as illustrated in Figs. 2, 3 and 4. Fig. 12 shows the diagram of such a motor at synchronism. The constants of this machine are identical with those of Fig. 11; the simplifying assumptions are also the same. In Fig. 12, $AL = e_0$; $LJ = e_{r_2}$ and $n = 1.00$.

The auxiliary compensating e.m.f. (e_0) is introduced into the rotor circuit along the motor field axis by way of the brushes $b\,b$. In magnitude, this auxiliary e.m.f. will, in practice, be equal to about one-fifth or one-fourth of the exciting e.m.f. (e_{r_1}) and this is the proportion which has been chosen in Fig. 12. The phase of e_0 will, as a rule, coincide with that of the terminal voltage P, for e_0 will generally be derived from the mains. The phase position of P, indicated by OP in Fig. 12, has been chosen arbitrarily in this case, but approximates to its true position in practice; therefore, $AL = e_0$ is made parallel to OP. Once the point L is located, the method of constructing this diagram is the same as that of the previous one, but the results now obtained are very different. Although the immediate effect of introducing e_0 is only to shift N_3 through a comparatively small angle, some 13.5 deg. in this case, in the direction of $v_1 N^0_1$, yet this slight alteration of the phase of the motor field has the most far-reaching influence on the operation of the machine.

The resultant OR in the transformer axis of the rotor is thereby shifted through about *130 deg.* and now comes *to lead e_1 by about 117 deg.*, instead of *lagging* behind e_1 by about 13

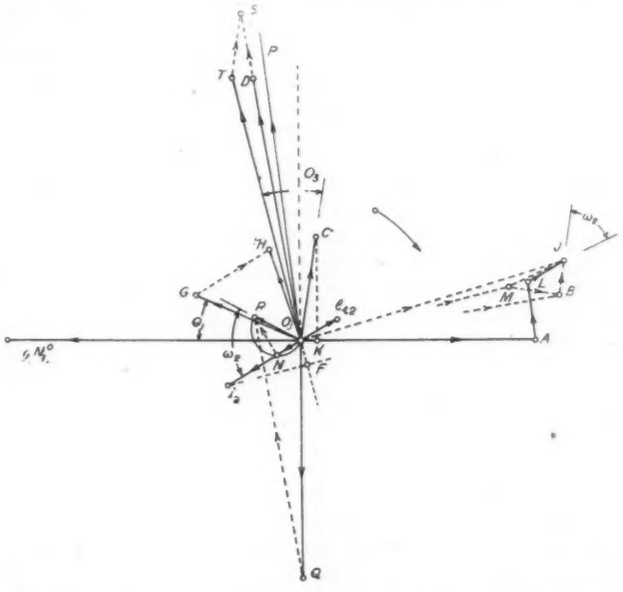


FIG. 12.—COMPLETE NO-LOAD PHASE DIAGRAM OF A COMMERCIAL INDUCTION MOTOR WITH ARTIFICIAL PHASE COMPENSATION.

deg. The result is that i_2 comes to lead e_1, and, therefore, may be made *to reduce the primary no-load current of the motor to a value even smaller than that of the primary magnetizing current and to bring the primary no-load current of the motor more into phase with the primary terminal voltage.* It is merely a matter of suitably choosing the magnitude of e_0. Although the losses in Fig. 12 have been taken abnormally great, yet $e_0 = \frac{1}{4} e_{r_1}$ is seen to be nearly sufficient to secure phase coincidence between i and P at no-load. It will be observed that angle HOP is only about 11 deg., which corresponds to $\cos \theta = 0.981$—an extremely high no-load value of the power factor.

In this motor (see Figs. 2, 3, 4 and diagram 12) the self-compensating e.m.f. (e_{r_3}) is, of course, added vectorially to $\overline{e_{r_1} + e_0}$ and the total e.m.f. impressed on the field circuit is $\overline{e_{r_1} + e_0 + e_{r_2}} = OJ$. Although in the partly or self-compensated motor (Fig. 1 and diagram 11) the tendency of e_{r_3} was always to *reduce* the magnitude of OJ at no-load, the addition of this e.m.f. in Fig. 12 will tend to *increase* the resultant OJ as soon as e_0 is made sufficiently large to bring i_2 into approximate phase coincidence with e_1. The resultant OR in Fig. 12 equals BA at synchronism and leads the latter by 90 time-degrees, as

was the case in Fig. 11, but BA now equals and opposes the vectorial sum $\overline{e_{r2} + e_c + i_2 w_2}$. The importance of the rotor time-constant in this type of motor is considerably reduced, although its influence is not to be neglected. A power factor of unity will be reached with the smallest e_c when w_2 and Θ_2 are both equal to zero.

Perhaps the most striking feature of an artificially compensated motor is the fact that while running synchronously and with a power factor near unity, it can develop a powerful main torque D_3, as may be seen from Fig. 12. Furthermore, since N^0_3 or OT leads $v_1 N^0_1$ by considerably less than 90 time-degrees, it is within the designer's power to make $D_1 = 0$ or even *positive* at no-load and nearly so throughout the load range of the motor. This condition can be reached with values of Θ_2 which are not extraordinarily small; in other words, the iron losses along the motor field axis can, in practice, be kept sufficiently low in order, with the help of e_c, to make $D_1 = 0$ and sometimes even positive. The torque D_2 is extremely small at all times, but it cannot be made zero even at no-load without making D_3 zero or negative, unless $x_2 = 0$, which is impossible in practice. Even for the unfavorable constants chosen for Fig. 12, it may be seen that $D_3 \equiv OF \times OT$ is considerably larger than $D_1 = OK \times v_1 N^0_1$; the difference may easily be made sufficiently large to cover amply the losses enumerated at the outset (under 5 to 7). The significance of these statements is that:

An artificially compensated shunt-induction motor can run at no-load at a speed equal to or exceeding the synchronous. Such a machine will, therefore, even give a certain amount of useful output before its speed sinks below the synchronous.

The artificially compensated shunt-induction motor shown in Figs. 2 to 4 is the only one in which the condition for a constant rotor velocity can be fully satisfied. For that purpose, it is necessary that i_2 shall lead e_1 by such an angle that the component of i_2, which coincides in phase and in direction with $v_1 N^0_1$, shall have a value sufficient to represent the recoverable energy periodically required by the rotor for the upkeep of N_3. It is seen that this condition will be practically fulfilled when the motor is fully compensated according to the author's method.

In the case of artificially compensated shunt-induction motors with commutators, the design should be slightly altered as compared with that of the same general type of machine without commutator. The importance of as small a value for w_2 as feasible is just as great, but the realization of this condition is extremely difficult owing to the presence of the sliding contact resistance introduced by the brushes $a\,a$ and $b\,b$. This means that, unless they are compensated, the full-load speed of these machines will generally be lower than that of a slip-ring motor. In view of this lower full-load speed x_2 should be kept small. Since a continuous-current rotor winding is used, this condition is rather convenient than otherwise. The iron losses along the motor field axis should be small.

Nothing has so far been said about the design of the stator, but this point can be settled very easily and the conclusions reached will apply equally to all the motors dealt with in this paper. A reference to Fig. 13 will show that when the power factor is good—and a good power factor must always be aimed at—then the tendency of $i_1 w_1$ is to reduce greatly N_1, and therefore $v_1 N^0_1$, to slightly improve the power factor and to lower the efficiency while the tendency of e_1 is to slightly reduce $v_1 N^0_1$ and to reduce greatly the power factor. If $v_1 N^0_1$ is much reduced with the increasing load, then the motor field N^0_3 will be similarly affected and the maximum output of the motor will decrease. This is a far more serious consideration than the slight improvement in the power factor which can be secured by making w_1 large. The resistance of the primary winding should, therefore, be made small.

In view of the fact, well illustrated in Fig. 12, that the primary reactance can only be compensated for at the expense of the torque (D_3) per ampere and consequently at the expense of efficiency, it appears most important that the primary reactance should be kept as low as possible and that the primary magnetizing current should be kept small.

The iron losses along the transformer axis have no effect on the torque conditions, but they, of course, reduce the efficiency. In motors of the induction type, and which run at a speed near the synchronous, the transformer and the motor fields are very nearly equal, and since it has been seen that in the case of motors of that type having a shunt characteristic the losses due to the motor field should be chosen low, then it follows that the losses due to the transformer field will also be low, although these could be made large without interfering with the operation of the motor. It is of importance to use as good an iron as possible for such machines, and, although the better iron costs more money, yet it will be found that this extra cost will be compensated for by the improved performance.

In conclusion, it may be pointed out that the performance and power factor of these single-phase shunt induction motors can also be improved by connecting a condenser in parallel either with the field winding itself or with a coaxial winding on the stator or rotor. The capacity of such a condenser, if used in conjunction with the ordinary single-phase induction motor shown in Fig. 1, for instance, should be so chosen as to bring i_2 in Fig. 11 at least into phase with OJ. The most objectionable effect of $i_2 w_2$ would thus be eliminated, N^0_3 would increase and lag by just 90 time-degrees behind OJ, while i_2 would be practically in phase with e_1 and would consequently be considerably smaller for the same torque, D_3. As a result, OH of Fig. 11 would approach the phase of OS and its magnitude would decrease. If the capacity of the condenser is chosen still higher,

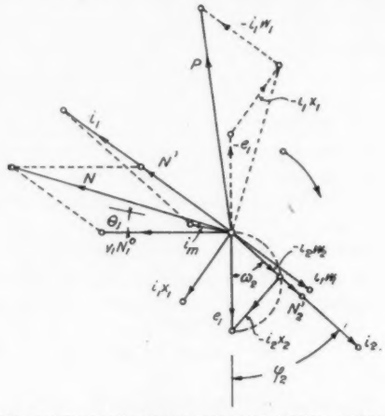


FIG. 13.—SHORT-CIRCUIT DIAGRAM FOR THE MOTOR SHOWN IN FIG. 1.

then i_2 will come to lead e_1 and conditions similar to those in Fig. 12 will obtain. There is a value for the capacity of this condenser beyond which it is useless to go, because an increase beyond that point will reduce the lead of i_2 on e_1 instead of increasing it. Such condensers have been proposed and used before now, but their effectiveness has been explained according to a totally different theory.

The use of such condensers appears to be specially indicated when it is desired to regulate the speed of a single-phase induction motor by inserting resistances into its rotor. Not only could the capacity of the condenser be so adjusted as to reduce D_1 to very small proportions, but the power factor could be kept high notwithstanding that the speed was being regulated. Such a condenser can be connected to a winding disposed on the stator and in the motor field axis. Resistances can be inserted into the rotor circuits in the usual way by means of slip-rings. Under these circumstances, the resultant current in the rotor along the motor field axis will be greatly reduced and the motor speed will be diminished, not so much because resistance is being inserted into the field winding—the resistance inserted therein can only have a very small effect, because of the smallness of i_3—but mainly because resistance is being inserted into the armature circuit. Since the condenser itself is connected to a circuit which is in inductive relation to the field winding and which acts as a secondary in respect to that field winding, it follows that the current flowing in that secondary will affect the magnitude of i_3 without materially affecting the magnitude of the motor field. Because of the fact that the mag-

nitude of the motor field decreases proportionately with the speed, the range of speeds to be obtained under load must still remain below that which can be secured with a polyphase motor in which the two or more motor fields per pole-pair remain practically constant with varying speed.

The author is well aware that his treatment of this intricate, though fascinating, subject leaves much to be desired; he, however, hopes that it will be found sufficiently clear and that his effort may be of some little help to the designer and also to anyone who is willing to go deeper into the whole question. It is thought, nevertheless, that all the points of practical interest have been discussed.

The author particularly directs the attention of the reader to the question raised relating to the recoverable energy alternately absorbed and liberated by the motor field N_3 and invites further study as to the exact nature of this phenomenon and as to its influence on the primary current taken by the shunt induction motor.

CENTRAL STATION

MANAGEMENT, POLICIES AND COMMERCIAL METHODS

Pacific Gas and Electric Magazine.

The Pacific Gas & Electric Company, San Francisco, has commenced the publication of a monthly organ, named the *Pacific Gas and Electric Magazine*, which differs materially from the usual central-station publication. A number of pages are given to excellently illustrated descriptions of parts of the company's plant, which is so extensive and varied that this feature can be continued over a long period. There is also in each issue a number of articles of a technical character likely to be of value to the employees of the company, and the August issue includes a well-written and illustrated history of gas lighting in San Francisco. Another feature is a biographical sketch in each issue of a member of the company's staff. About half of the contents relate specifically to the routine operations of the company. In typographical appearance, illustrations, arrangement of matter and evidences of editorial skill, the publication is much in advance of other central-station organs of this country, which considerations appear to justify the policy of the company in attaching a subscription price and aiming at a general circulation for the periodical.

A Form for Keeping Isolated Plant Data.

One of the important things in preparing to get the loads of various isolated steam and gas-engine plants by a central station is for the central-station company to get complete and accurate information regarding the isolated plants in its territory. The accompanying form was used by the Consolidated Light, Power & Ice Company, Joplin, Mo., under Mr. C. W. Hough, formerly general manager of that company, to whom we are indebted for the present copy. The items on this form are printed on a pamphlet with four leaves having dimensions 5¼ in. x 8¼ in.

DATA ON PLANT.

Of .....
Location .....
Business .....
Chief Engineer.....
Address .....
Name of Party to See.....
Record Opened.....

STEAM PLANT.

No. Boilers.....Water Tubes or Horizontal.....
Return Tubular.....Rated H. P.....
Are Boilers fed by Pump or Injector?.....
Where is Water Obtained?.....
Is a Feed Water Heater Used?.....
Bituminous or Anthracite Coal Used?.....
Is coal hauled by wagon or delivered from cars to boiler room?.....
Capacity of coal storage.....
No. of engines used.....
Are they slide valve, simple or compound-automatic cut-off high speed and what are they rated at in H. P.?.....

.....

.....

Is exhaust steam used and for what purpose?.....

.....

Is live steam used other than for engines? For what purpose?

GAS PLANT.

No. of engines used.....
Type..... Make.....
H. P. Rating.....Cooling Water.....
Date installed.....

Character of Work of Each Unit.

Mill .....
Compressor .....
Pump .....
Hoist .....
Incline Tram.....
Remarks .....

.....

ELECTRICAL PLANT.

No. dynamos.....Make.....
Voltage..... Age.....
Capacity .....
No. Motors.....Make.....
Voltage..... Age.....
No. (16-cp equivalent) lamps connected.....
No. incandescent arc lamps connected.....
No. high tension arc connected.....
Amperage .....
Maximum load.....
Average load.....
No. elevators.....If electric, size of motors.....
If hydraulic, size of pumps.....
No. Ice machines.....
System..... Capacity.....
How driven.....
What is the system of heating?.....
Direct or indirect radiation?.....
What is back pressure on engines?.....
Number of square feet radiating surface.....
Cubical contents of building.....
Character of building.....
Is it exposed?.....
Is the load steady or intermittent?.....
Approximate length of shafting.....

Remarks on Layout of Plant.

.....

.....

Attached Cards from Engine Test or Readings from Test Meters.

.....

Expense of Operating Plant.

Fixed Charges.	Approximate.	Exact.
Interest upon $..... at 5 per cent..	$.....	.....
Depreciation upon $.....at 10 per cent..	.....	.....
Insurance, Fire.....	.....	.....
Insurance, Boiler.....	.....	.....
Insurance, Liability.....	.....	.....
Taxes	.....	.....
Rental value of space occupied by plant.....	.....	.....
Damage from heat and vibration.....	.....	.....
Total	$.....	.....

Operating Expense.

No. Engineers.....at.....	.....	.....
No. Firemen.....at.....	.....	.....
No. Electricians.....at.....	.....	.....
No. Dynamo-tenders.....at.....	.....	.....
No. Helpers.....at.....	.....	.....
Tons Coal.....at.....	.....	.....
Removal Ashes.....at.....	.....	.....
Water Rent.....at.....	.....	.....
Oil and Waste.....at.....	.....	.....
Repairs to Boilers.....	.....	.....
Repairs to Engines and Dynamos.....	.....	.....
Incandescent Lamps.....	.....	.....
Carbons	.....	.....
Tool Account.....	.....	.....
Miscellaneous	.....	.....
Total	$.....	.....

Hours daily plant is operated.....
Hours daily open for business.....
Monthly income from Steam or Electricity sold.....
General conditions and system of wiring.....
Regulation and General service.....

Propositions for Central Station Service.

.....

Special Street Lighting at Aberdeen, S. D.

One of the smallest cities in the country to adopt special lighting of its principal business street by means of lamps on artistic iron posts supplied by underground service is Aberdeen, S. D. This is a little city of about 10,000 inhabitants. From the appearance of its main street, which is excellently paved and brilliantly lighted, an impression is created on the visitor to the city which is seldom equaled in a town of this size. The

FIG. 1.—ARTISTIC LAMP POST AT ABERDEEN.

post used in this lighting is shown in Fig. 1, while Fig. 2 shows the appearance of Main Street at night.

Each post has five 60-watt tungsten lamps in opalescent globes. There are 39 posts in all. On Main Street five blocks are thus lighted. There are six posts per block. Four are placed at each street intersection at the corners of the sidewalks and two midway between street intersections, as indicated by Fig. 3. These posts are the property of the Aberdeen Light & Power Company. The city of Aberdeen pays the company $5 per month per post. The scheme was promoted by the Commercial Club, which secured the right-of-way for the company's wires over buildings from the alleys.

A rather unusual arrangement of electrical supply for these lamps is used. Fig. 3 shows the general scheme of wiring. In the alleys on either side are four transformers, two in each

FIG. 2.—ABERDEEN STREET AT NIGHT.

alley. These transformers are connected on a three-wire system. One transformer gives 440 volts on its secondary, the other 110. The center lamp on each post, which burns all night, is connected to the 110-volt side and the other four lamps on the post are connected four in series on the other side of the three-wire system, which gives 440 volts. The top lamp burns all night and those on the arms are turned off at 11 p. m. A time switch in the company's office turns off the lamps on one side of the street and another time switch in a box on a post in the alley turns off those on the other side of the street.

The wires are brought from the secondary main in the alleys through an iron-pipe conduit over each building and down the front of the building to the sidewalk. There is one such feeder in the center of each block which comes down the front of the building opposite the middle post of each block and feeds both ways by means of iron-pipe conduit buried in the concrete sidewalk. Fig. 4, which was taken during construction, shows one of these conduit pipes coming down the side of the building and the partially filled groove in the sidewalk through which this conduit runs. The ends of the conduits, which were later covered by the post, are seen at the curb line of the sidewalk.

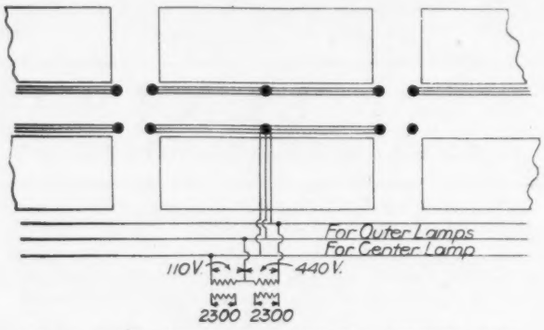


FIG. 3.—LAMP CIRCUIT DIAGRAMS FOR ABERDEEN POSTS.

Fusible cut-outs are placed at the central posts of each block. As the blocks are 300 ft. long, the circuits feed 150 ft. each way from the center of the block. The conduit is ¾-in. galvanized pipe smoothed out with a square-ended reamer. The secondary mains in the alleys from the transformers to the conduit are No. 8 weatherproof wire. For the pipes No. 14 single-braid rubber-covered wire is used. The trench was broken in the

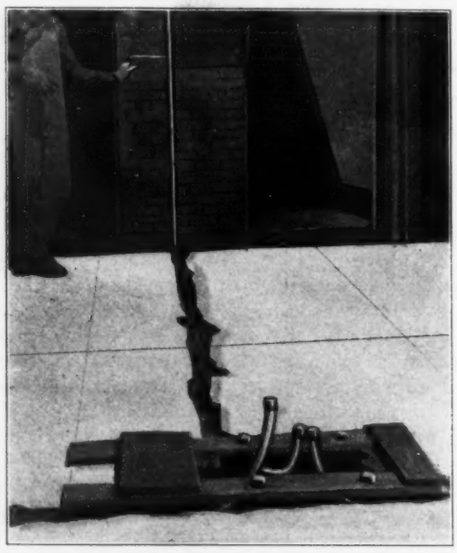


FIG. 4.—CONDUIT DOWN SIDE OF BUILDING.

concrete sidewalk by means of a railroad spike hammer. The cost of this installation complete was slightly over $100 per post. It was started in operation on June 15, 1909. The installation was planned by Mr. J. B. Gibbs, electrical engineer of the Aberdeen Light & Power Company.

English Gas and Electric Competition.

By Glenn Marston.

IN America, where the major portion of capital invested in lighting is in combined or affiliated gas and electric companies, co-operation between the two forms of lighting has taken the place of competition. In Great Britain, on the other hand, there is only one private company supplying both gas and electricity, although a considerable number of municipalities operate both services.

In America, where the majority of capital invested in lighting is in combined or affiliated gas and electric companies, co-

operation between the two forms of lighting has taken the place of competition. In Great Britain, on the other hand, there is only one private company supplying both gas and electricity, although a considerable number of municipalities operate both services.

The English gas man hates electricity as a monkey does water, and much energy is expended by each industry in showing how intolerable are conditions under the other. In America the gas man relies on cheapness in competing with electricity, and convenience in competing with coal. Not so his English brother. The most aggressive foe of electricity is the Gas Light & Coke Company, of London, and, as an editor once told the writer, "the slanders of our enemies only serve to arouse us to our own virtues." The gas man's arguments are not slanders, but they may serve to reveal opportunities for new business which make knowledge of them worth while.

Aside from the weekly repartee of the gas and electric journals, both industries produce quantities of pamphlets, good and bad, bearing on their respective merits. The journalistic digs of one service against the other are in themselves an education, for it seems to be felt that nobody would read the periodicals unless deeply interested in the subject, and they handle one another without gloves. That this feeling of safety from the layman's curiosity is well grounded is shown by one electrical journal's recent announcement of a special number: "Next week's issue will be twice as thick as usual."

Neither industry permits the other to occupy certain fields, as is done in America. Gas is used for lighting and electricity for heating to the utmost possible extent. The gas companies are attacking electricity, both on matters of cost and efficiency. Authorities whose reputations are backed up by long strings of letters resembling a child's train of building blocks are called in, and physicians innumerable (with only two or three alphabetical titles attached to their names) lend their influence in one direction or the other.

One of the most imposing of these dissertations is a paper by Dr. S. Rideal, prepared for the Royal Sanitary Institute, on "The Relative Hygienic Values of Gas and Electric Lighting." It is a book of 132 pages, illustrated with many diagrams, and has been reprinted and widely circulated by the Gas Light & Coke Company. The trend of the paper is to prove that in some respects gas is superior to electricity, while in no respect is electric light in the slightest degree superior to gas from the standpoint of hygiene.

Dr. Rideal's experiments covered the atmospheric changes in a room occupied by from one to eight persons; the ventilation produced by either type of lamp and the results thereof; the presence of organic matter and bacteria; the effect on respiration and other details of physical condition, and the sensitiveness of the eye under each form of light. A 50-cp Darwin inverted gas burner and an Edison & Swan 50-cp incandescent electric lamp were used in the experiments.

Some of the conclusions are rather remarkable from the standpoint of the central station. For example, Dr. Rideal finds that "the difference found between the two lights were so small as to be absolutely devoid of any hygienic significance; they were, in fact, much less than those that are constantly produced in healthy subjects by slight changes in their condition or environment."

Dr. Rideal holds that the circulation of air produced by gas lighting induces better ventilation and results in better atmosphere in the ordinary room than can be secured when electric lamps are used, since the heat from electric lighting is insufficient to create air currents. He then says, in the very next sentence, "The electric lamps really produced more heat than is commonly credited to them. This seems to be the explanation of the unexpected result that the average temperature of the rooms was practically the same under either illuminant, and that the electric lamps did not show the superiority of coolness usually claimed."

The only difference in the ophthalmic tests are so slight as to be ineffective under ordinary circumstances. Very delicate tests were necessary to detect any difference whatever. The presence of bacteria is reduced, according to Dr. Rideal, under gas light because the flame sterilizes all air which comes in contact with it.

Another pamphlet of this company is entitled "Towards the Solution of Two Urgent Problems of Modern City Life." The two problems are the abatement of London fogs and the servant question. The gas company says that the "pea-soup" fog of London is due to the smoke from the thousands of house chimneys. (Steam heat is unknown in England, save in a few hotel corridors and an occasional public building.) If all the fireplaces now burning coal were equipped with gas-grates, says the pamphlet, fogs would become ancient history.

One phase of the servant problem is solved by a customer who writes: "I would not be without my gas fires for anything. They cost me nothing, because on the day they were fixed I gave one of my maids notice, and my year's gas bill does not exceed the cost of that maid, while I save my coal bill as well."

It is but natural that the majority of the gas companies' publicity should be upon the value of illumination. On the side of the central station, very little work is done toward promoting new business. In Glasgow one canvasser is considered sufficient to care for almost a million prospective customers. Other cities do no canvassing whatever. There are only a few exceptions to the rule of letting electrical business take care of itself. A few central stations around London are active—spurred on by the energy of the Gas Light & Coke Company—but outside of the Metropolitan District new business organizations are confined almost wholly to the large companies, which operate over large areas and are chiefly interested in securing the patronage of concerns doing a large business.

That the gas industry in England is more progressive than the central stations is evident on all sides. Much important street lighting is done by gas companies. Gas stands first in public esteem because it is constantly before the public through the unremitting efforts of the publicity men. It is only within the past year or two that the electric plants have given serious attention to new business.

Strangely enough, the interest now manifested by central stations in new business methods is not due to the loss of customers to gas companies. The advent of the tungsten lamp has done more to awaken the British central stations to the necessity of aggressive new business methods than did all of the attacks of the gas companies.

The central stations have made no attempt to govern the sale of tungsten lamps or to direct their use along lines that would least affect the revenues. The sale of tungsten lamps has been pushed by the contractor and discouraged, ineffectively, by the stations. The contractors have sold low-wattage lamps and, as a result, cut down energy consumption to an alarming degree, in some cases to a point where the consumption does not bring in sufficient revenue to meet interest and maintenance charges. When this occurred the central stations had to get busy in order to save themselves from improvements in their own business, and they turned to the gas consumer as the most likely means of maintaining the lighting load so fast being depleted by tungsten lamps. The battle is now at its height. The tungsten lamp has forced action from both the central stations and the gas companies. One is striving to maintain its output, the other to retain its customers.

The City of Westminster Electric Supply Company, Ltd., which supplies energy in Southwest London, has adopted a novel scheme of bringing electricity to the notice of every resident of its district. A few weeks ago it began opening temporary display rooms, in which were exhibited all the usual appliances An exhibit is held for two or three weeks, then moved to another vacant store near by and again set up. It is the intention of the company to continue these exhibits until one has been held within a few hundred feet of every resident of its district. Much interest has been aroused by the exhibits and, if inquiries indicate possible customers, the experiment will be a complete success.

INTERIOR WIRING AND ILLUMINATION

Arrangement of Concealed Conduit.

An examination of most of the wiring plans prepared for concealed conduit work is apt to create the impression that conduit lines are run haphazard under or between floors, in walls, partitions, chaces, behind lathing, furring, etc. Such, however, is not the case. In all first-class installations certain general rules are followed, which may be summarized as follows:

Conduit laid under floors for the electrical circuit work is installed in a manner best suited for and adapted to the specific kind of flooring. As a general rule the conduit is run in straight lines and parallel with the walls of the building or of the rooms. If the floor is of concrete, mosaic or tile, the conduit, owing to the absence of wooden floor sleepers, may follow the most direct route in nearly all cases. Ordinarily, all horizontal runs of conduit are placed under the flooring of the floor to which they correspond, and horizontal or cross-runs in partition or side walls are rarely allowed. The number of bends in any section of conduit from one drawing point to another must not exceed four, not including those at the ends, and offsets, long bends, triangular "short-cuts," etc., should be used only where obstructions are to be overcome or certain difficulties present themselves.

The conduit must be properly secured in position by means of pipe clamps or other suitable fastenings, and sufficient fastenings must be provided to obviate sagging or play wherever the conduit is not embedded in concrete or other filling, or wherever it is not otherwise held in a firm position. If the proper support and fastening cannot otherwise be secured, suitable wooden supports must be provided for that purpose. Conduit must in general be adequately anchored in position and braced or guyed if necessary, so as to resist displacement or distortion when the wires are being pulled in or out.

Wiring of Christmas Trees.

At this time of year almost every electrical contractor and supply house is besieged by fond parents and others for Christmas tree outfits, and while many purchase the standard series outfits for connection to electric light sockets, very many purchase battery outfits, employing either storage or dry cells, usually the latter. Unfortunately, there seems to be a lack of knowledge on the part of those who make up these outfits as to the proper size of wire to employ. The impression prevails that because these are miniature outfits, small, inconspicuous magnet wire is all that is necessary, and if the lamps do not burn brightly a few more cells of battery are added to boost the voltage.

For the purpose of showing the error of this choice in wire size, a case may be assumed. It is desired to wire a 10 ft. tree with 10 1-cp 2-volt lamps. The average length of the 10 branches at whose end a lamp is to be placed is 3 ft. A 10 per cent drop in voltage is allowed. A miniature 1-cp lamp takes about 6 watts, so that with a tension of 2 volts a current of 3 amp is necessary for each lamp, or a total of 30 amp in all. In wiring the sockets it is assumed that each circuit is brought back to the trunk of the tree and connected to a riser running along the trunk from the battery on the floor or stand. If the average distance through which the entire current must pass is taken as 5 ft., and only one size of wire is desired, these values may be substituted in any wiring formula and it will be found that a wire with a cross-section of 16,500 circ. mils or a No. 8 wire is required. It is doubtful if any of the outfits sold over the counters of supply houses are equipped with so large a wire, and fortunately it is an easy matter to add a dry cell or two to compensate for the short-sightedness of the maker of the outfit. Batteries are more expensive than wire, however.

Ornamental Street-Lighting Posts at Salt Lake City.

Salt Lake City has recently gone in for lighting its downtown streets from ornamental posts carrying tungsten lamps.

FIG. 1.—COMBINATION POST, SALT LAKE CITY.

One of the characteristic features of the work in Salt Lake City which differs from that in other cities is that some of the

FIG. 2.—LAMP POST, SALT LAKE CITY.

posts are combination lamp and railway posts, as shown in Fig. 1. The design used where a post is for lamps only is shown in Fig. 2.

Large Roof Signs in New York.

The accompanying illustrations show three large roof signs erected in the "White Way" district of New York City. The mineral-water sign, shown in Fig. 1, is located at the northeast corner of Broadway and Forty-second Street, in the center of the hotel and theatrical district. The sign is 32 ft. high by 50 ft. long, and contains more than 2500 lamps, the design calling

FIG. 1.—MINERAL WATER SIGN.

for three colors, green, white and red. The lamps are in continuous action, giving the effect of a fountain spurting up from the ground. A novel feature has been introduced into the display by utilizing steam coming from the heating plant of the building on which the sign is erected. Pipes extend to the top of the sign, so that when the steam is liberated it

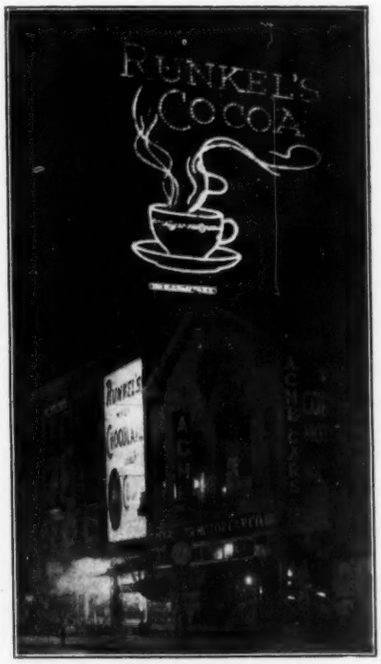


FIG. 2.—COCOA SIGN.

hovers above the letters, and imparts to the fountain an effervescent effect resembling spray in a real water fountain.

Located on the east side of Broadway, between Forty-fifth and Forty-sixth streets, is a cocoa sign, shown in Fig. 2. This overlooks Longacre Square, one of the greatest night centers in the world. The sign contains 1250 electric lamps of red, amber, blue and green, and is 44 ft. high by 50 ft. wide. Like the sign just described, this is also in continuous action. The cup and saucer remain fixed, and curved lines emerge so as to represent the vapor arising from a steaming-hot cup of the beverage advertised. Since the picture was taken the words "Highest Grade" are caused to appear in the vapor rising from the cup.

Fig. 3 shows a sign at the east side of Broadway, corner of Thirty-seventh Street. This is one of three all alike located at prominent points on Broadway; and while these are smaller than most of the large signs along the latter thoroughfare, be-

FIG. 3.—A BROADWAY SIGN.

ing 14 ft. high by 30 ft. long, the effective arrangement of the words gives a rather strong display. The signs flash on and off, first appearing blank, then the words at the upper left and lower right-hand corners are flashed, followed by the words at the lower left and upper right corners. Each of the signs contains 750 lamps.

New Telephone Patents.

NEW APPARATUS.

While transmitters have been designed with free-edge diaphragms, most transmitters are secured to some extent at the edges. The usual method consists in snapping a rubber ring over the circumference of the diaphragm, this latter being held in place by rubber-faced dampening springs.

Messrs. C. E. Egner and J. G. Hulmström, of Sweden, however, have found that a diaphragm under strong radial stress is more sensitive and they have, therefore, arranged and patented a transmitter with a view to this stressing. The edge of the diaphragm is held fast between flutings and a straining ring, with the circular knife edge forced down concentrically upon the diaphragm. This stresses radially all portions inside the knife edge, to the center of which portion the electrode is secured.

A receiver-supporting arm forms the subject of a patent granted to Mr. H. R. Palmer, of Seattle, Wash. The arm swings from a clamp secured near the base of a desk stand, and both the radial distance of the receiver and the angle of the bar are adjustable to meet the needs of any user. In the non-use position a latch on the arm serves the double purpose of depressing the switch lever and latching up the arm.

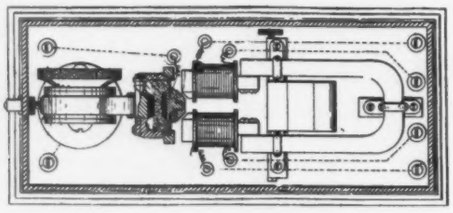
LOCK-OUT SYSTEM.

A lock-out system has been patented by Mr. F. E. Summers, of Scotland County, Missouri. The line is in sections normally connected together. In calling in one direction, the line behind is cut off. Thus, in the case of two stations, there can be no listening of stations beyond either, while any intermediate station breaking in cuts the line and gets in connection with one or other of the talking stations. In order to provide for emer-

gencies upon the outward ends of the line, cut off at each of two communicating stations, an extra receiver is provided at each station so connected electrically as to always be associated with the cut-off end; while it is so associated with the regular receiver mechanically that it is inconvenient not to have it against one of the ears while using the regular instrument with the other ear.

NEW REPEATER.

Mr. N. G. Warth, of Gallipolis, Ohio, who has obtained in the past several patents for telegraph repeater circuits, etc., has recently patented a repeater apparatus. This is shown in part section below, the view being a plan. The horseshoe magnet covers the receiving coils. The poles of these latter are beveled to conform to the bevel of the armature, a small block mounted directly upon the mica diaphragm of the transmitter. This cuts



WARTH TELEPHONE REPEATER.

down the moving parts to a minimum simplicity. The rear wall of the microphone button is re-entrant, to afford a better disposition of the granules. The air-gap of the magnetic circuit is adjustable through a spacing screw in the transmitter mounting, and the permanent magnet is provided with an adjustable magnetic shunt block for deflecting the polarizing field from the air-gap. These adjustments provide for the accomplishment of maximum efficiency of action.

RAILWAY DESPATCH SYSTEM.

In despatching trains by telephone under a positive block system, it is essential not only for the despatcher to have connection with every tower, but each of these latter must have communication with the one next on either side of it. To accomplish this requirement upon one circuit is the object of the invention of Mr. O. M. Leich, of Genoa, Ill., the patent being assigned to the Cracraft-Leich Electric Company. At each tower there are two phantom coils cut into the circuit. The two windings of one of these are so connected as to cut the line into sections. The second is cut in so that a despatch instrument will at all times be able to receive any message coming forward on the through line. At each tower there are taps led off from the neutrals of the first phantom coil, to which may be connected an auxiliary telephone instrument which works over the grounded local phantom so that the adjacent tower may be called and communicated with without interference with the through line.

MESSAGE REGISTERS.

A signaling and locking system for message registers is the subject of a patent granted to Mr. A. S. Spiegel, of Chicago, Ill. The system contemplated embraces an individual register for each line, a position register to give position totals, and a key connection with each cord pair to connect the registering current to the third or sleeve wire of the cord. The invention lies in a double winding of the line meter so that it operates under the influence of one of its windings and is locked by the other. The resistances are adjusted so that the position meter will fail until the line meter is locked, while when the position meter does work it causes a lamp to glow and indicate the fact. Mr. Spiegel's patent is assigned to the American Telephone & Telegraph Company.

This same company is assigned a patent granted to Mr. S. H. Browne, of Pittsburgh, Pa., for the application of a message counter to a telephone system of the call-distributing type. The total number of successful connections must be counted, irrespective of which trunk happens to be automatically selected to display the calling signal on the switchboard.

Letters to the Editor.

Electrical Units and Notation.

To the Editor of Electrical World:

Sir:—In your journal of Oct. 21 you have been good enough to discuss in a very friendly spirit the latest report of the Committee on Units and Notation of the Elektrotechnischer Verein, for which please accept our thanks.

It is the great desire of this committee to select such a notation and such names of units as appear to be best fitted to enter into international use. Your comment on the use of the letter *A* for *arbeit* (work) will be taken into consideration in a later revision of our propositions.

As to the second recommendation of the committee which you discuss, and which relates to alternating-current phenomena, we have not yet attempted to formulate a definite notation, that in the report being only employed to record formulas. The object of the recommendation was merely to suggest names and definitions for the more important quantities relating to alternating-current phenomena, and the preliminary notation used was not considered entirely satisfactory by the committee. Some of the suggestions contained in your editorial seem thoroughly worthy of attention.

Berlin, Germany. Karl Strecker,
Chairman Committee on Units and Notation,
Elektrotechnischer Verein.

The Lux as the Unit of Illumination.

To the Editor of Electrical World:

Sir:—I have read with much interest in your issue of Oct. 28 the letter by Dr. Berthold Monasch on the successively different values given to the lux in certain countries. I am entirely of the opinion of Dr. Monasch that it is very difficult to know with a sufficient exactitude the values of light units as they enter in the electrical literature of the last 10 years of the past century.

The excellent system of photometric units adopted in Geneva in 1896 on the proposition of Professor Blondel has made considerable progress. I agree with Dr. Monasch and recognize that it is very regrettable to find a difference of 13 per cent (from 0.98 to 1.11) between the value given in 1896 and in 1909 for the ratio of the bougie-decimale to the hefner; but should we conclude that during this period one of the units has varied 13 per cent? As a matter of fact, such a swift and summary judgment would be in error.

The hefner was investigated very completely in 1895, and had received a specification from the Reichsanstalt in 1893, since which date this lamp has not varied. I believe I can say personally (I have been engaged in photometry since 1894) that the difference of 13 per cent in the value of the bougie-decimale would similarly not be possible. The inconsistency is very readily explained by reference to the state of knowledge, at first very imperfect and then progressively more precise, of the ratio of the two units. When the Geneva congress decided in 1896 that for industrial measurements the bougie-decimale could be represented provisionally by the hefner, it relied upon the value given in 1891 by M. Violle for the ratio of the hefner to the bougie-decimale. The comparison, however, had been made before the specifications of the hefner lamp were put forth, which specifications are now recognized as necessary to insure exactitude. The Geneva proposal was adopted without either verification or opposition.

In 1898 I gave the ratio of the bougie-decimale to the hefner as 1 to 0.885, pointing out that my several results differed by 2 per cent. Subsequently a correction of 1 per cent was applied to this first result, and the ratio adopted by the International Commission of Photometry in 1907 of 1 to 0.895 is admitted to be within 1 per cent. Since then, in 1909, with a

view to simplification and as within the limits of approximation indicated in 1907 at Zurich, it has been agreed to accept 1 to 0.9 as the ratio of the bougie-decimale to the hefner.

Is it necessary to assert that the value of the lux or of the hefner-metre has varied? Not at all. Should we employ for the ratio of the bougie-decimale to the hefner the value 1 to 1.02 for photometric measurements made in 1896, and 1 to 0.9 for those of 1909? Certainly not. These variations simply show that in 1896 our knowledge as to the ratio to employ was not sufficiently exact, while at present this ratio can be stated as known to within 1 per cent. We can thus use without hesitation the present value for application to all previous photometric data whatever their date, provided, of course, that such measurements were made after, and were based upon, the specifications of the hefner. The present value of the ratio will probably not be subject to any important modification, for it seems now to be known with all approximation that one can expect from the definition and the constancy of the standards to which it applies.

PARIS, FRANCE. F. LAPORTE,
Sous-Directeur du Laboratoire,
Central d'Electricite.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Abstracts of the important articles appearing in the electrical periodical press of the world

Generators, Motors and Transformers.

Field-Magnet System.—J. W. BURLEIGH.—An illustrated description of a new field magnet system for generators and motors. It consists of a number of horseshoe magnets with commutating poles arranged as shown in Fig. 1. The angle Θ

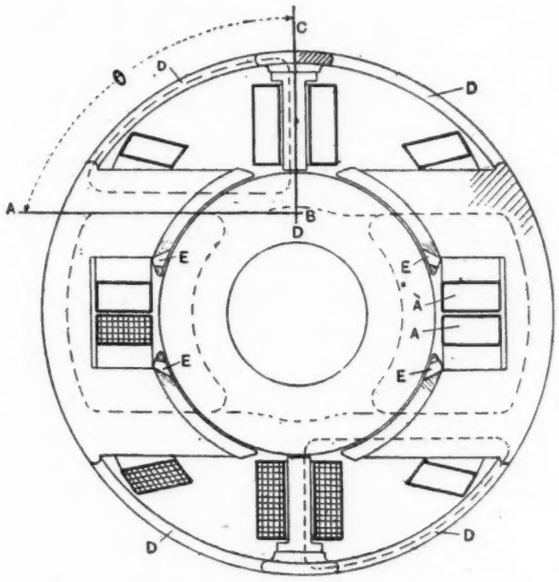


FIG. 1.—FIELD MAGNET SYSTEM.

between the axis of a main pole core and the axis of a commutating pole $= \frac{360 \text{ deg.}}{NP}$ — where NP equals the number of main poles. This is a distinctive feature of the design. The arrangement of the poles and windings is shown diagrammatically in Fig. 2. The full line represents a winding of a series-wound

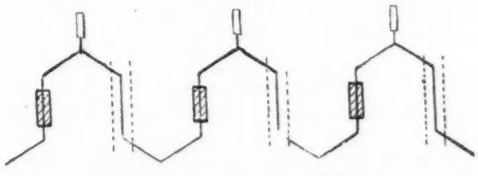


FIG. 2.—DIAGRAM OF WINDING.

armature, the dotted lines the portions of the field coils, and the rectangles the commutating poles. Portions *AA*, Fig. 1, of the main exciting coils are brought directly over and parallel with the armature conductors undergoing commutation. This particular position of the field coils lessens the self-induction of armature coils undergoing commutation and saves a considerable amount of copper on the commutating poles. From actual tests it would appear that the excitation required on each commutating pole is not in excess of that required for each commutating pole in a machine having an ordinary magnet system, in which the auxiliary and main poles are equal in number. It is found, too, that the brush position is not nearly so sharply defined as in the usual commutating-pole machine. With this particular construction magnetic leakage is reduced to a minimum. The chief advantages of the system are claimed to be reduction of magnetic leakage, extremely light field cores and improved ventilation. Detailed figures are given of the design of a 500-volt, 12-hp, 1050-r.p.m. motor and a 500-volt, 200-kw, 400-r.p.m. generator.—Lond. *Elec. Review,* Nov. 26.

Regulation of Voltage of Alternators.—M. SEIDNER.—The use of inherent voltage regulation (making use of saturation and stabilization of the magnetic field) is uneconomical, since alternators provided with special voltage regulators can be built much more cheaply. The author discusses the general properties which regulators should have and briefly sketches the theory of the voltage drop in alternators. He then divides the different methods of voltage regulations of alternators into six groups as follows: In the first group the exciting current required for regulation is obtained from the alternating current of the generator by means of a commutator running in synchronism with the generator (Ganz, General Electric Company, Corsepius, Heyland, Alexanderson). In the second group the direct current for excitation is also obtained from the alternating current, but a special magnetic field is used to facilitate commutation. This group is subdivided into two classes, one of which comprises the converter methods in which the no-load current is also taken from the alternator, while the other class comprises those methods by which the no-load current is produced by exciters (Hutin-LaBlanc, Boucherot, Blondel, Rice, Danielson, Steinmetz, Ziehl, Roth, Union Company). In the third group the direct current for excitation is produced from the alternating current by means of aluminum electrolytic rectifiers (Dobrowolsky). In the fourth group the magnetic reaction of the armature is used for regulation (Walker, Heyland). In the fifth group the alternating current is not changed into direct current, but acts mechanically on a rheostat inserted in the shunt excitation circuit (Blathy, Thury, Dick, Thiele, Tirrill, Schwaiger). In the sixth a rheostat is acted upon, not mechanically, but by purely electric, magnetic or thermal methods (Seidler, Crompton & Company, Parsons). The author begins to discuss some 30 of the more important different methods. The article is to be continued.—*Elek. Zeit.,* Nov. 25.

Interpole Motors.—A anonymous article on direct-current machinery. Special reference is made to the connections of the field windings of compounded and interpole machines. The adjustment of the current in the interpole windings and the position of the brushes of interpole motors and generators are dealt with, and the influence of brush position on the speed characteristics of interpole motors are referred to. By giving the brushes a slight forward lead, surging and the rise of speed under full load, sometimes obtained with interpole motors, are avoided. The speed characteristic of an interpole motor of

500 volts, 40 hp, 800 r.p.m. is shown in Fig. 3. Curve I shows the speed with brushes at the neutral position, curve II with the brushes given half a segment forward lead. A good machine would usually allow of one segment forward lead being given

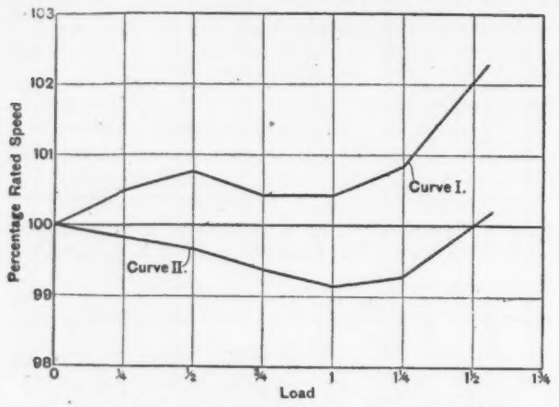


FIG. 3.—SPEED CHARACTERISTICS OF INTERPOLE MOTOR.

to the brushes before sparking commences. A much simpler way out of the above difficulty is to supply a series winding, so that as the load comes on the machine the series turns help the shunt field and keep down the speed and at the same time the machine is perfectly stable. This method is used in every case with a reversible motor, in which the brushes must necessarily be fixed on the neutral.—Lond. *Elec. Eng'ing*, Nov. 25.

Transformers.—W. R. Rogowski.—A theoretical paper on the stray flux and stray flux coefficient of transformers.—*Mitt. Forschungsarbeiten Ver. Deut. Ing.* No. 71; abstracted in *Elek. Zeit.*, Nov. 25.

Lamps and Lighting.

Illuminated Engineering.—S. P. Thompson.—In his inaugural presidential address to the (British) Illum. Eng'ing Society the author emphasizes the confusion which exists in photometric units. Agreement as to what shall be taken as the unit of light and what as the unit of illumination at a surface must be secured. The former appears to be settled, but about the unit of illumination there is still some disagreement, both the lux and the ft.-candle being used. Adopting the latter for present purposes, all authorities are agreed that for reading at night not less than 1 ft.-candle is required. Reading is impossible with an illumination of less than 0.1 ft.-candle, difficult and fatiguing with 0.25 ft.-candle, comfortable with from 1.5 to 3 or 4 ft.-candle, and dazzling if the illumination exceeds 6 ft.-candles. Very seldom does the artificial illumination exceed 3-ft. candles, though in a room receiving direct sunlight 4 or 5 ft.-candles may be attained. No one can have worked at the photometry or modern lamps without becoming conscious of much misunderstanding existing as to the elementary laws of illumination, the inverse-square law, if often misapplied, being used in calculations of illuminations from sources other than points. Other subjects which should be taken up are the specific brightness of surfaces of different kinds when subjected to a standard illumination, and a number of semi-physiological problems. For schoolrooms at least, rules should be formulated on illumination. They ought to require an illumination of 1.5 ft.-candles at the worst lighted seat, but excess illumination must also be avoided. Holland appears to be the only country in which legislation has fixed a statutory amount of illumination, the figure being from 10 to 15 meter-candles or from 0.9 to 1.35 ft.-candles.—Lond. *Electrician*, Nov. 26.

Tungsten Illumination.—A. J. Sweet.—An article giving fundamental rules on the best methods of using tungsten lamps, with applications to specific cases, like the lighting of stores, desk lighting, shop-window lighting, etc.—*Elec. Journal*, December.

Generation, Transmission and Distribution.

Multi-Speed Drive by Induction Motors.—H. C. Specht.—An illustrated article on the use of multi-speed drive in steel mills. During the process of rolling, the rolls working on different sections require different speeds; the smaller the section the faster the speed required. In a mill which always rolls the same material and the same sections, the different speeds at the respective rolls are generally obtained by mechanical devices and sometimes, in addition, by two or more motors. A number of rolls for the first passes are driven by one motor, faster and slower speeds being obtained by speed-changing devices, such as pulleys and belt, rope drive, or gears. A number of the

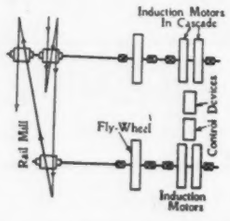


FIG. 4.—LAYOUT OF MILL WITH MOTOR DRIVE.

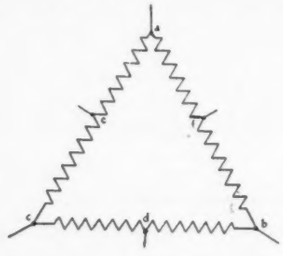


FIG. 5.—ARRANGEMENT OF PRIMARY WINDING.

succeeding rolls are similarly arranged in group drive to be operated by a second motor, which may itself operate at a higher speed than that of the first motor. A drive of this character is illustrated in Fig. 4. In a mill where different materials and different sections are to be rolled at various times some arrangement of multi-speed motors (depending on the special nature of the case) must be used. In general it is desirable to limit the number of speeds and select such speed ratios as can be obtained with the least complication and lowest cost. Several methods are described; one of them is used with a continuous mill at the works of the Pennsylvania Steel Company, Steelton, Pa. In this case a 300-hp, 300-volt, 25-cycle, three-phase motor of the two-speed type is used, the speed corresponding to this output being 375 r.p.m. (synchronous speed). The output at the slow speed, 187.5 r.p.m., is 150 hp. The primary (stator) consists of concentric windings with an average coil throw corresponding to 16 poles. For high-speed operation, corresponding to eight poles, the primary winding is connected in parallel-star, while for low-speed operation, or 16 poles, the winding is connected in series-delta. Six leads are brought out from the primary winding to the switching devices, as shown in Fig. 5. For the delta connection the leads *a, b* and *c* are connected to the three-phase line, the leads *d, e* and *f* being disconnected. For the star connection *a, b* and *c* are connected together, and the leads *d, e* and *f* are connected to the line. Another method is that of the Illinois Steel Company, where a large rail mill is operated by means of two identical cascade sets. The motors operate on a 2200-volt, 25-cycle, three-phase circuit, the rating of each set being 1800 hp at 83.3 r.p.m. (synchronous speed) and 1200 hp at 125 r.p.m.

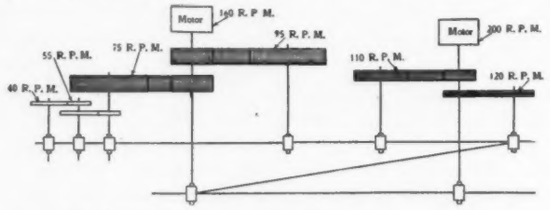


FIG. 6.—DIAGRAM OF MULTI-SPEED MILL DRIVE.

One motor of the set is wound for 24 poles and the other for 12 poles, the two rotors being mounted on a common shaft. The motors are directly connected to the roll spindle. A fly-wheel is also employed on the common shaft. To obtain the slower speed, the two motors of the set are connected in direct concatenation. For high-speed operation the 24-pole motor is operated as a single machine. In either case the primary of the 24-pole motor is connected to the line. This mill rolls rail from different materials and of various cross-sections and is also employed for rolling various sizes of bars. Although more

than two speeds could be obtained with this cascade set, only two are employed, the motors being designed accordingly. Operation at the high or low speed is of course dependent on the material being rolled; however, both sets are always operated at the same number of poles. Fig. 6 shows diagrammatically the arrangement of the motors and mill. The author finally discusses the use of multi-speed drive of pumps and blowers.—*Elec. Journal,* December.

Electric Power in Steel Mills.—C. F. SCOTT.—A paper in which the author explains how the use of electricity removes former limitations in steel mills. He discusses the cost of energy and the cost of motors and emphasizes that the latter is the least important item. As to the selection of motors and the use of alternating current he thinks that common-sense mechanical instinct will choose nothing but alternators and induction motors, the simplest kind of generator and the simplest kind of motor. Rotary converter, direct-current motor and synchronous motor are, therefore, put on the defensive. They must show specific advantages, which will more than compensate for their disadvantages. The question of power factor is discussed and summed up as follows: The power factor has little or no effect on the engine or the work which the motor does, but is a matter incident to the electric system alone. If proper provision be made, its effect should not appear in the mechanical operation of the apparatus. The power factor should be provided for in the design of the electrical system and although the induction motor does not require larger generating equipment, yet this can usually be provided and the system installed and operated more economically and efficiently than it could by any other class of apparatus; moreover, it is simpler.—*Elec. Journal,* December.

Regulation of Transmission Lines.—A. J. SOPER.—After a general discussion of the principles of regulation and energy losses of transmission lines, the author describes a new and simple method for the predetermination of transmission line regulation. It requires no difficult mathematical calculations at all, but makes use of tables. It is based on the fact that the power that can be transmitted over a line at a given voltage multiplied by the distance of transmission is a constant for the same percentage voltage regulation and energy loss. If it is desired to find the size of wire to transmit a given amount of power over a given distance with a fixed percentage regulation it is only necessary to multiply the horse-power with the number of miles of transmission. This gives a figure which is looked up in the author's tables from which the size of the wire may be found immediately. The tables given in the article refer to copper conductors used for 60 cycles and 25 cycles and a power factor of 80 per cent; to transmission e.m.fs. between 1000 volts and 60,000 volts; and to spacings between 18 in. and 72 in. The tables may be used to solve any of the following problems: To find the size of wire for a given line drop; the size of wire for a given watt loss in the line; the line drop and watt loss for given sizes of wires; the maximum amount of power that can be transmitted for given sizes of wires with definite line drop or energy loss; the effect on the line drop of frequencies of 25 cycles and 60 cycles; the effect on the line drop and energy loss of the power factor of load with given sizes of wires. Various numerical applications of the method are added.—*Canadian Elec. News,* December.

Electric Marine Propulsion.—H. J. ORAM.—Some notes on the reasons why the various proposals for electrical propulsion of warships had not received the most favorable consideration of the British Admiralty. In some of the electrical designs submitted the total increase in machinery weights was as much as from 15 to 20 per cent. The gain at low powers would require to be very substantial to balance such increases. Moreover, the voltages suggested were considered to be too high for safety. In the designs submitted to the Admiralty there had been no gain in the space occupied, but in some cases an increase.—Lond. *Elec. Eng'ing,* Nov. 25.

Pump.—H. A. HUMPHREY.—An illustrated paper read before the (Brit.) Inst. Mech. Eng. in which the author describes an internal-combustion pump in which the explosive force is exerted directly upon the water. Official tests show that a consumption of 1.06 lb. of anthracite coal per pump hp-hour has been obtained with only a small plant. The thermal efficiency at low pressures is much higher than with an Otto cycle. In conclusion, a suggested central station is outlined, in which pumps would supply water to water turbines coupled to electric generators.—Lond. *Electrician,* Nov. 26.

Traction.

Single-Phase Road in London.—A note on the opening of electric operation on the South London Elevated Electric Railway, which is the first line in England to commence electrification on the single-phase system. The equipment is with an overhead conductor supplying current to the trains at 6700 volts, 25 cycles. Each motor coach is equipped with four Winter-Eichberg 125-hp, single-phase commutator motors supplied at a pressure of from 150 volts to 750 volts from transformers on the coach.—Lond. *Elec. Eng'ing,* Nov. 25.

Installations, Systems and Appliances.

Swiss Power Station.—H. DE BEAUSOBRE.—A description of the new water-power station of Lonza, in the Ackersand district in Switzerland. A waterfall of 730 m high is utilized. The plant will contain five generating units, of which only one has so far been erected. Each unit will have a rating of from 5500 hp to 6000 hp. The three-phase alternators give directly 15,500 volts. The number of revolutions per minute is 500. The current is 190 amp per phase. Among the features of the installation are the automatic oil interrupters, which opens instantaneously and without the slightest danger, a circuit carrying 30,000 hp.—*Revue Industr.,* Oct. 23; *La Lumière Elec.,* Nov. 13.

Electric Lighting and Electricity Charges.—H. W. HANDCOCK AND A. H. DYKES.—A paper read before the (Brit.) Inst. Elec. Eng. The authors first review the change brought about by the extensive adoption of metallic-filament lamps. They show that the flat rate of charging is certain to prove unsatisfactory, and that for small consumers excellent results can generally be obtained by a fixed charge of $3 per 25-cp lamp per year, including free wiring rental, no meters being used. Large consumers, for which this system would prove too expensive, would have a limit indicator fixed, and the charge would be based on the maximum number of lamps required to be used at one time. The authors prophesy a successful future for undertakings conducted on these lines.—Lond. *Electrician,* Nov. 26.

Electricity in Harbor.—O. HEINISCH.—The conclusion of his illustrated article on electricity supply in the Ruhrort harbor. Current is supplied over a 10,000-volt double-cable line of 12 miles length from the electricity works in Essen. The distributing network has a total length of 11 miles with 44 transformer stations, the total rating being 3200 kva and the e.m.f. of distribution 5000 volts. Electricity is used for the operation of cranes, for loading coal and for lighting (523 arcs and 410 metallic-filament lamps of 100 cp). The lamps are lighted from a distance from 16 different points by automatic clock apparatus. The construction of this apparatus is described in detail.—*Elek. Zeit.,* Nov. 25.

Constant-Current Regulators.—H. A. LAYCOCK.—An illustrated article on the principal arrangements of constant-current regulators. The cycle of operation of the current regulator is practically the same as that of the voltage regulator, with the principal difference that the regulating magnets of the former are designed with series coils instead of shunt coils.—*General Elec. Review,* December.

Switchboard.—L. B. CHUBBUCK.—An illustrated article on concrete switchboard structures.—*Elec. Journal,* December.

Wires, Wiring and Conduits.

Fuses.—M. T. MACCALL.—A paper read before the Leeds Section of the Brit Inst. Elec. Eng. The usual formula due to Preece, namely, $I = k.D^{3.2}$ (where I = fusing current in amperes, D = diameter of wire in inches and k = constant for any particular material) is not applicable to stranded wires, because the wires diminish each other's emissive power to an extent which can be determined only by experiment. All that can be

predicted is that a two-strand fuse will carry less than twice the fusing current of either of its equal wires, and probably more than 1.41 times this current, and for a three-strand fuse the current will lie between 3 and 1.73 times that of the single wire, and so on. The objects of these experiments were to determine the variations in Preece's "constant" (or in the emissive power) with change of diameter; to determine the effect on fusing current of house service fuse holders, and to find the ratios of the fusing currents of single and stranded fuses in the open and in fuse holders. The experiments were confined to tin fuses in air and one type of fuse holder, and dealt chiefly with single and two-strand fuses. The wire contained 99.6 per cent tin, and corrections were made for temperature. The results for single wires connected for an air temperature of 16 deg. C. are given below:

Diameter mils.	S. W. G.		Fusing current amperes.	$10^3 \times E$	$k \div 10^3$
15.3	28	in Air	3.58	2.60	1.89
21.9	24	in Air	5.26	2.42	1.66
28.6	22	in Air	7.53	1.77	1.56
15.3	28	in Fuse Holder	4.58	4.27	2.42
21.9	24	in Fuse Holder	6.28	3.44	1.94
28.6	22	in Fuse Holder	8.17	2.08	1.69

The value for 28 S.W.G. in air is for the fuse in a horizontal position; all others are for the fuse in a vertical position. The value of E (the emissivity) can be calculated either from the actual fusing currents or from the values corrected as above to an air temperature of 16 deg. C. Preece's constant (k) is given for the diameter in inches. The values of E and k decrease with increasing diameter, especially for fuses in holders; in fact, in the latter case, the fusing current, instead of varying as $d^{1.5}$, does not vary even as rapidly as the diameter, but about as its 0.92 power. A similar table of two-strand fuses is given below:

Diameter mils.	S. W. G.	Twists per inch.		Fusing current amperes.	$10^3 \times E$	$k \times 10^3$
15.3	28	3¾	in Air	5.37	1.47	1.42
21.9	24	3	in Air	8.85	1.37	1.37
28.6	22	2	in Air	13.0	1.32	1.34
15.3	28	3½	in Fuse Holder	6.37	2.06	1.68
21.9	24	2¾	in Fuse Holder	9.38	1.53	1.44
28.6	22	2¼	in Fuse Holder	13.4	1.52	1.39

The same general results are seen here as for the single fuses, except that k varies less, especially in air, probably because the results for 28 S.W.G. are less affected by its being placed horizontally than they are in the case of single wire. The ratio of the fusing currents for single and double fuses varies from 1.39 to 1.73. A few experiments were made on three-strand fuses, which gave a fusing current of a little over twice that of single wires of the same size.—Lond. *Elec. Eng'ing*, Nov. 25.

Electrophysics and Magnetism.

Elementary Electric Charge.—R. A. Millikan.—The author describes a new modification of the cloud method of measuring the elementary electric charge. His determination gives 4.87×10^{-10} in absolute electrostatic units. The results of all the recent determinations by methods which seem least open to question are given below:

Planck	4.69
Rutherford and Geiger	4.65
Regener	4.79
Millikan	4.65
Begeman	4.66

Mean $e = 4.69 \times 10^{-10}$

The value of Begeman was obtained by the regular Wilson method.—*Physical Review*, December.

Electric Charges Acquired by Insulated Radioactive Substances.—J. C. McLennan.—An account of an experimental investigation of the electric charges acquired by insulated potassium salts and other radioactive substances in high vacua. The results of the research show that in high vacua both potassium sulphate and potassium nitrate emit an excess of charged particles of the beta type. The effect observed in all cases was small, and it required exceptional conditions to bring it into evidence. From the results obtained so far it has not been found possible to decide whether or not any radiation of the alpha type is emitted by the potassium salts.—*Physical Review*, December.

Double Refraction.—A paper by T. E. McComb on the dispersion of electric double refraction and ordinary dispersion in liquids, and a paper by C. A. Skinner on the dispersion of magnetic double refraction in liquids compared with that of electric double refraction.—*Phys. Review*, December.

Radioactivity.—J. Elster.—The conclusion of his lecture on the present status of our knowledge of radium and radioactivity.—*Elek. Zeit.*, Nov. 25.

Units, Measurements and Instruments.

Laboratory Applications of the Photo-Electric Current.—F. K. Richtmyer.—An abstract of a recent Physical Society paper. The production of measurable photo-electric currents from a sodium surface by extremely feeble illuminations suggests this phenomenon for use in making photometric measurements of monochromatic or of isochromatic light sources where observations by eye are extremely difficult. For example, the author has studied the decay of phosphorescence of a sample of Balmain's paint for a period of over an hour following a half-minute excitation by sunlight. The curve is of the usual form, and when plotted with $1/\sqrt{I}$ as ordinates, shows three distinct linear branches. It is also pointed out that this combination of photo-electric cell and electrometer acts as a time integrator for light intensity in much the same way that an electrolytic cell would measure total quantity of electricity. In this connection the cell might be used to study short decay phosphorescence, or, as has been done by the author, to measure the total quantity of light passing through a photographic shutter during exposure.—*Physical Review*, December.

Meters.—An official announcement of the Reichsanstalt, by which an induction meter of the Isaria Company is admitted for calibration at the Reichsanstalt. It is intended for two-phase or three-phase systems with unbalanced phases. The meter consists of two single-phase meters on the same axle. The construction and method of calibration are described.—*Elek. Zeit.*, Nov. 25.

Absolute Measurement of Electric Resistances.—Hurmuzescu.—A paper presented before the French Academy of Sciences on a method of absolute measurement of an electric resistance in electrostatic units. The principle of this method is as follows: A condenser with the charge $Q = CE$ is discharged from Q_1 to Q_2 through a resistance R. During this time its capacity decreases from C_1 to C_2, while the potential E remains constant so that $dQ = EdC$. The current I thus produced is $I = dQ/dt = E/R$. From these two relations it follows that $RdC/dt = I$. It is thus possible to obtain directly the value of R if the variation of the capacity in time, or the differential quotient of C with respect to time, can be measured. A suitable arrangement is a cylindrical condenser formed of two circular concentric cylinders.—*La Lumière Elec.*, Nov. 6.

Electromagnets.—A. Beringer and R. Edler.—A continuation of their experimental investigation of electromagnets for switches and apparatus. In the present installment they describe their experiments on the influence of heating on the tractive force. The effect of the temperature seems to be quite complicated.—*Elek. und Masch.* (Vienna), Nov. 7.

Measurement of High Inductions.—E. Gumlich.—The first part of a paper on the measurement of high inductions by a modification of the isthmus method of Ewing. The paper is to be concluded.—*Elek. Zeit.*, Nov. 11.

Localization of Cable Faults.—E. Raymond-Barker.—In a continuation of his illustrated article on cable fault localization graphs in practice the author considers the Heurtley test graphically.—Lond. *Elec. Review*, Nov. 5.

Paper Condensers.—E. H. Weiss.—An article on the design of condensers for telephone purposes, constructed of paper covered with a layer of tin. The author thinks that the cylindrical form is the most convenient one. In the present article he calculates the best ratio of height to radius of the cylinder.—*La Lumière Elec.*, Oct. 6.

Telegraphy, Telephony and Signals.

Telephony.—L. E. Wilson.—A paper read before the Manchester Section of the (British) Inst. Elec. Eng. on various problems of telephony. With respect to engineering matters in

connection with exchange work he referred to insulating tests. Taking 1000 lines under old conditions, the author stated that on a wet day 40 per cent tested under 100,000 ohms; the use of Sinclair-Aitken leading-in insulators, which introduces a dry section between the leading-in cable and the outside wire, raised the insulation considerably, and, under the same atmospheric conditions, only 23 per cent proved to be under 200,000 ohms. An investigation of low insulation and the cause subdivided the responsibility as follows: Outside lines, including the leading-in wire, 37 per cent; window terminals, 27 per cent; office wiring, 19 per cent; instruments, 7 per cent. After receiving individual attention, no line tested under 7 megohms. The author then analyzed the faults occurring in private telephones under the following headings: wiring, primary batteries, bell troubles, instrument cords, transmitters, generators, receiver, lightning arrester, damp walls and cradle switch.—Lond. *Elec. Eng'ing*, Nov. 25.

Wireless Telegraphy.—Two papers on coupled wireless telegraph systems. J. Kaiser deals with the transmitting system and discusses the effect of the degree of coupling on amplitude and damping of the waves produced. G. Heinecke deals with the receiving system and its best arrangement to get maximum effect.—*Phys. Zeit.*, Nov. 22.

Directive Wireless Telegraphy.—L. H. WALTER.—A note on the Belini-Tosi system of directive wireless telegraphy, with special reference to the problems of constancy of coupling and the phase relations.—Lond. *Electrician*, Nov. 26.

Cable Telegraphy.—K. W. WAGNER.—A mathematical paper on the transmission of telegraphic signs over long cables, with special reference to the effect of the insertion of condensers at the transmitting and receiving ends.—*Phys. Zeit.*, Nov. 22.

Barretter.—BELA GATI.—Some notes on the difficulties he has encountered in making half-micron (0.0005 mm) platinum barretters, and on their efficiency. The best current is 2.5 milli-amp. With a current of 3 milli-amp the wire is destroyed in air.—*Phys. Zeit.*, Nov. 22.

Miscellaneous.

Birmingham.—E. A. ALLCUT.—The first part of an illustrated article on the University of Birmingham and its electrical engineering department.—Lond. *Electrician*, Nov. 26.

Ignition.—J. W. WARR.—An illustrated paper read before the (Brit.) Inst. Elec. Eng. on the principles of electrical ignition of internal combustion engines.—Lond. *Elec. Review*, Nov. 26.

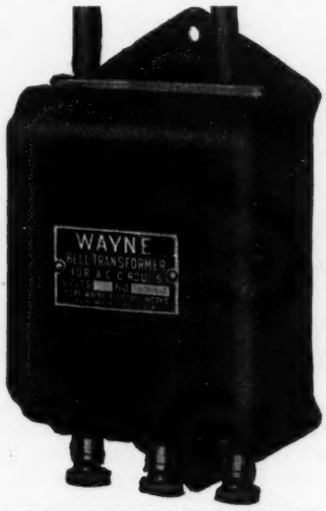
Electric Laboratory.—ROESSLER.—The first part of an illustrated description of the electric engineering laboratories of the Institute of Technology of Danzig, Germany.—*Elek. Zeit.*, Nov. 25.

Apparatus for Melting-Point Determinations.—W. P. WHITE.—A paper discussing various apparatus especially useful for the determination of melting points at high temperatures. Platinum resistor furnaces of simple construction provide complete control of the temperature for melting-point work up to 1600 deg. C. Where uniformity of temperature throughout the working chamber is important special modifications are necessary. Small charges (2.5 grams) give very sharp points, are economical of material and permit of convenient manipulation. A number of advantages result from the use of a second thermo-element, which is made to show directly the furnace temperature about the charge. The measurement and regulation of the heat supply from the furnace is a factor of great importance in accurate melting-point determination. The author describes methods of treating and insulating thermo-elements and of avoiding the effects of contamination, suited to various conditions and kinds of work. He concludes with the description of several methods developed by him.—*Amer. Jour. of Science*, November.

NEW APPARATUS AND APPLIANCES

Transformer for Bell Circuits.

The transformer shown herewith is made by the Fort Wayne Electric Works, Fort Wayne, Ind., for the purpose of utilizing alternating current for operating electric bells, annunciators and similar low-voltage apparatus, to take the place of dry cells, which are oftentimes a source of more or less trouble. The transformer is built for 110-volt circuits, and has a secondary winding with taps brought out so as to obtain 4, 8 or 12 volts, depending upon the connections. In electric bell wiring, frequently the bell wires are run along the floor and are apt to be short-circuited. For this reason the transformer is designed so that it will operate for several hours on dead short-circuit without danger of burning up. This feature makes the transformer valuable for this class of work. The efficiency of the device is quite high for a transformer of this size. The core loss is said to be approximately 0.4 watt. The primary leads consist of two rubber-covered flexible cables brought out through an insulating piece, anchored inside the case to prevent injury to the winding, due to pulling of the leads. The secondary terminals consist of three binding posts giving three combinations of voltages. This is the maximum combination which can be obtained through this number of binding posts. The casing is of cast aluminum covered with a heavy coat of black japan, so that the transformer may be installed in places where the appearance of dry cells would be objectionable. There is an air space between the body of the case and the wall upon which it would be mounted. The core and coils are thoroughly impregnated and the same care and quality of material are said to be used as in the construction of the transformer as in large high-voltage transformers.



TRANSFORMER FOR BELL CIRCUITS.

Tough Tungsten Lamps in a Wreck.

The collision between a Pennsylvania eastbound passenger train and an empty engine just outside Jersey City on the morning of Nov. 8 resulted in comparatively few injuries to the passengers due to the fact that the strong frames of the passenger cars resisted crushing. The damage to engines and cars, however, was considerable. One of the steel passenger coaches jumped the track and turned over on its side, denting in the steel plates about 18 in.

In the lighting equipment of this car were nine General Elec-

tric tungsten lamps. It is interesting to note that, after the wreck, when all the lamps were taken out and tested, the tungstens were found to be in perfect condition—a further proof of the rather remarkable strength and durability of the tungsten filament when specially adapted for train lighting service.

Automatic Acceleration Induction Motor.

The motor illustrated in Fig. 1 is similar in general appearance and operating characteristics to the Wagner self-starting, single-phase repulsion motor, but differs therefrom in being a polyphase machine of the usual induction type. It is provided with a secondary short-circuiting device operated by centrifugal force identical in every respect to the device used with the single-phase machine, but there are no brushes bearing on the commutator, and hence no mechanism for removing them when full speed is attained. The motor is, in fact, a polyphase induction machine which starts from rest with a secondary of high-resistance and operates under load conditions with a secondary of low-resistance, the change from high-resistance to low-resistance being accomplished by means of the centrifugal short-circuiting mechanism just referred to.

The performance of the motor during the starting period is indicated in Fig. 2. At the first instant of starting the motor consumes three times the normal current and exerts a torque three times the normal full-load value. As the rotor speed increases both the current and torque gradually decrease, until the speed has reached the value at which the centrifugal mechanism comes into action to decrease the secondary resistance when the current and torque are suddenly increased and the rotor rapidly accelerates to the speed indicated by the load and consumes a current corresponding thereto. The motor now operates in every respect as a polyphase machine with a rotor secondary of the squirrel-cage type.

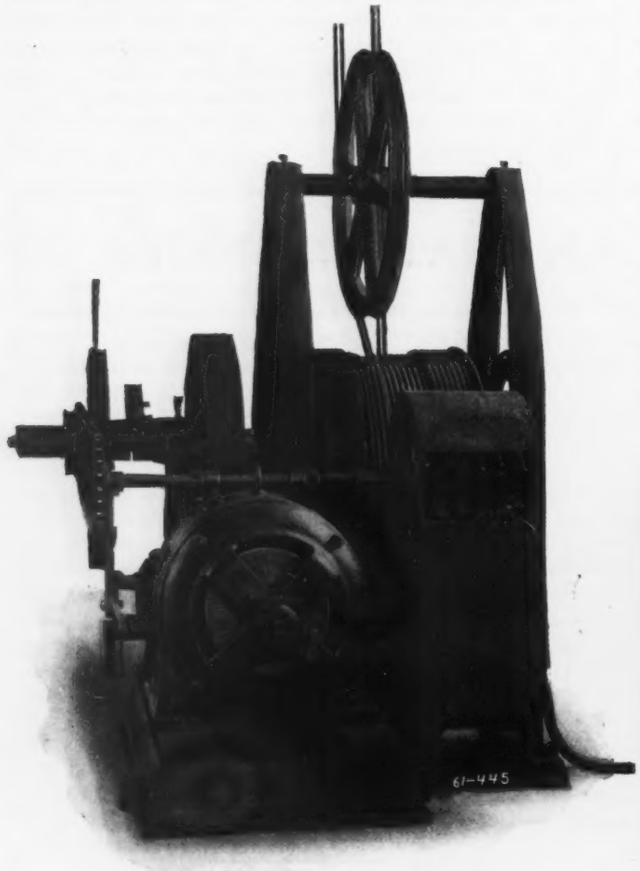


FIG. 1.—MOTOR-DRIVEN ELEVATOR.

In addition to possessing the desirable operating features of the low-resistance, squirrel-cage motor, the machine exerts a high torque while consuming a low value of current at starting, being in this respect similar to an induction motor of the slip-ring type. However, the only external starting device is a simple single-throw, three-pole, main line switch. The latter feature renders the motor particularly suitable for remotely controlled apparatus, such as pumps and elevators. The operation of the motor is entirely automatic, so that following any interruption to the supply of energy the motor returns at once to the starting condition and accelerates from rest when the supply is restored.

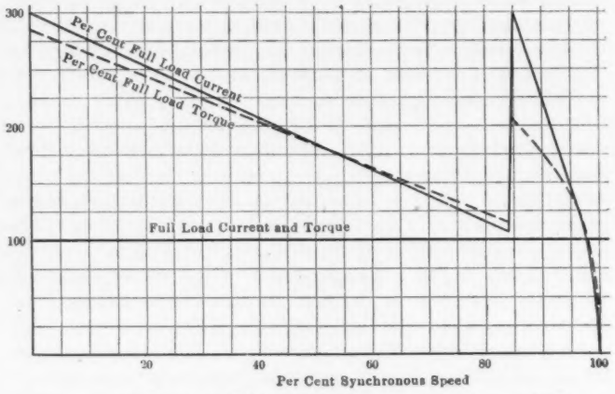


FIG. 2.—STARTING CHARACTERISTICS OF INDUCTION MOTOR.

The motor described above has been placed on the market by the Wagner Electric Manufacturing Company, St. Louis, Mo.

Westinghouse Electric Repair Department.

For some time past the Westinghouse Electric & Manufacturing Company has felt the need of a special department to handle repair work independently of all other work, so as to insure prompt attention and quick deliveries, but the crowded condition of the works required the erection of another building before such a department as the management had in mind could be established.

On account of the fact that there was no large space on the company's 47-acre plot unoccupied, it was necessary, in the erection of a new building, to depart from the established two-story type of structure and to erect an eight-story building. The available space was 110 ft. wide by 420 ft. long, and the building is 70 ft. x 400 ft. The distance from the ground to the top of the cornice is 130 ft. The building is of skeleton self-contained steel and brick construction, and is as near fireproof as a building can be made. It contains approximately 220,000 sq. ft. of floor space.

FOURTH FLOOR, NEW REPAIR DEPARTMENT BUILDING.

Although surrounded on all sides by other buildings, the new building has excellent receiving and shipping facilities. A covered shipping platform on the east side, paralleled by a railroad siding, extends the full length of the building. The ground floor is connected with the rest of the works by a narrow-gage industrial railway system, and the second floor is connected with the surrounding buildings by means of covered bridges.

To facilitate the handling of material from floor to floor one exceptionally large freight elevator and five high-speed combination elevators are employed. They are all electrically operated by means of Westinghouse motors and controlled by automatic elevator controlling apparatus.

The building affords working space for approximately 1500 people. In addition to providing for practically doubling the present output of detail apparatus, it affords ample room for handling in the most expeditious manner a large volume of repair work.

New Meter for Measured Telephone Service.

Engineers of the Chicago Telephone Company and other Bell telephone companies have been working for more than two years in an endeavor to produce a message register which could be placed at a subscriber's station and so operated as not to impede or interfere with the general service of the Chicago exchange. Before the passage of the recent telephone ordinance in Chicago the adoption of message registers which required the subscriber to ring a special bell or make a special signal when called upon to do so by the operator, after connection had been made, was discussed at considerable length. Such forms of register had been designed and manufactured to some extent, but never generally introduced. It was agreed at that time that the delays put upon the exchange service by registers operated in this way would be almost unbearable. The problem of designing a meter which overcomes this difficulty seems to have been finally solved by Associated Bell telephone engineers, and the latest model, just received by the Chicago Company, will overcome, it is believed, the difficulties previously encountered. The subject is still under consideration, however, by a committee of the Chicago City Council.

The new telephone meter recommended by the Chicago company consists of a small steel box about 5 in. x 2½ in. and standing out from the wall about 4 in. At the top is a small glazed aperture back of which four disk wheels carry the numbers indicating the number of calls furnished the subscriber. At the right is a push-button, to be operated by the subscriber when he originates a call. In calling, the subscriber presses the button. This signals the operator in the central office, who answers in the usual way. If the call is completed, the operator presses a key associated with her apparatus which operates the mechanism in the register which counts as one call.

If the call has not been completed, because the desired line is busy or for any other reason, the operator presses another key, which releases the mechanism, but does not register a call. The keys manipulated by the operator are identical with those used in the nickel service where the operator presses one key to drop a coin into the cash box and another to return it to the person calling. This register enables calls to pass along freely, just as in the case of the coin box where the nickel is first deposited to signal the operator. The subscriber who is called is not delayed, and a fair rate of speed of operating can be maintained. The instrument, therefore, seems to be well adapted to conditions of telephone service as they are found in Chicago and is applicable to measured-service lines.

After some further service tests on exchange lines in various localities the work of manufacturing tools by means of which this instrument may be turned out will be rapidly prosecuted, if the meter is finally approved by the city authorities, and everything possible done to get the instrument ready for introduction on the premises of such subscribers as may desire it and who have the class of service adapted to it.

English System for Securing 100 Per Cent Central-Station Load Factor.

A description appeared in a recent issue (Nov. 18) of the Therol water heater, which aims to secure 100 per cent load-factor customers for central stations, and which is being introduced in some British central stations. The Therol Company has now opened a New York office in the Hudson Terminal Buildings, 30 Church Street, where the apparatus is on exhibition.

Briefly, the Therol system is based on heat storage. The apparatus consists of an iron block, cylindrical in shape, enclosing a removable heating unit, a coil for producing superheated steam being imbedded in the block. When current is desired for lighting or other domestic uses it is automatically switched off from the heater, so that the load factor remains constant.

The apparatus has been in use for several months in British central stations, where special rates have been given, bringing the price of energy down to about a fifth of the ordinary rate for lighting. Auxiliary appliances are connected which provide for instantaneous boiling water at any time of day, and for other domestic purposes.

The standard size heater consumes 300 watts continuously, and is capable of producing 40 gal. of water at 100 deg. Fahr. in 24 hours. In case the apparatus is not used for lighting it can be automatically cut out during the station peak through the operation of a time switch which requires winding once in three months.

Among the arguments for the Therol system is that whereas up to the present time no system of heating or cooking by electricity has been devised which would not have to be considered as having an appreciable effect on the peak, the heat stored up by the Therol apparatus can be used for hours after the current which produced it is turned off, so the central station is in the morning perhaps, or even at dead of night, producing current which will be turned into heat for cooking or water heating during the afternoon and evening.

The cooking apparatus follows the same principles as the water heater described in former articles, and includes an auxiliary water heater if desired. The current consumption for an ordinary cooker is approximately 100 watts, as once the iron block is thoroughly heated it is only necessary to maintain the requisite temperature. In the cooker the iron heat-retainer is built around an oven-like chamber of firebrick, in which all cooking—boiling, roasting, etc.—may be done save broiling. An insulated table hung on counterweights forms the bottom of the cooker. On this are placed the articles to be cooked. The table is placed in position and requires no further attention until the cooking is completed.

There are no switches to be watched under the Therol system, as the whole current-supplying apparatus is automatically regulated. The heating units are in sections, and as soon as current is demanded for lighting or ironing as many heat units are disconnected as necessary, the current then being used for other purposes. When the lights are turned off the current is automatically taken up again by the heating units.

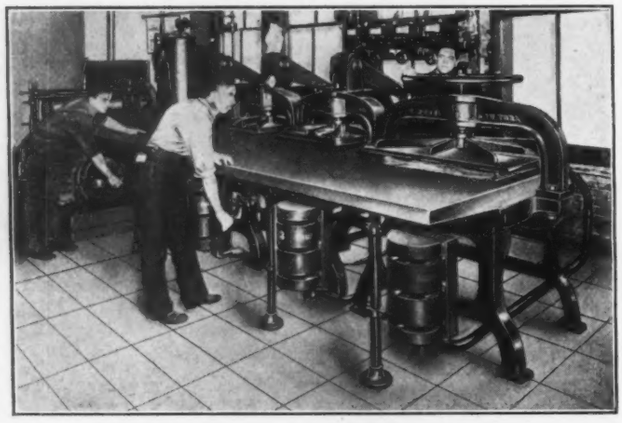
With a combined water heater and cooker the temperature of the cooker can be adjusted to any desired degree. The cooker is equipped with a thermostatic switch, which introduces current into the cooker's heating units in sufficient quantity to keep the iron block at a predetermined temperature, which current is drawn from the water heater's constant supply. In case a higher temperature is desired in the cooker than that indicated by the thermostat—for quick cooking, for example—the thermostat can be switched off and all available current introduced into the cooker, the water heater in the meantime, of course, consuming no current, thus maintaining the central station's 100 per cent load factor.

An important factor in the Therol system is the small amount of current constantly demanded. It is therefore possible to have a complete heating and cooking outfit in a residence without increasing either the size of services, the capacity of the station or the cost of producing current, save for fuel.

Electric Matrix-Drying Table.

In the daily race against time in the newspaper office, during the last hurried minutes before the paper is put to press, no appliance recently added to the printing-plant equipment has worked such practical improvement in speed, reliability, convenience, cleanliness and in comfort as the electric matrix-drying table.

With it, "mats" are dried in one-half to one-third the time required by older methods. The close control of the electric heat enables the temperature to be held accurately at the desired point. The controllers are mounted on brackets beneath the bed of the machine, convenient of access to the workman.



MATRIX-DRYING TABLE.

A very large number of temperature gradations is available. The temperature is shown by an electrical thermometer, the indicator of which is mounted upon an adjacent wall or firm support.

The superior economy of electric matrix driers over those heated by steam, gas or other means, lies in the possibility of applying the heat directly to the work, the other parts of the bed being thoroughly insulated against radiation and conduction losses. As a result of this isolation of the heating element, the temperature of the stereotyping room is much reduced, and since its atmosphere is not devitalized from supporting combustion as with the gas-heated table, an improvement in the comfort, health and work of the operators has been many times demonstrated as the result of the coming into the market of the electric matrix drier.

Combined with the greater pressure possible with the use of compressed air supplanting the effort of the hand-wheel, the high temperature of the electric hot-bed results in the production of matrices of greater sharpness and depth, and of superior printing quality. As noted before, the time of drying can be cut to one-half that of any other process, the actual amount depending, of course, on the quality of the work to be done. It is possible, however, to thoroughly "bone-dry" a matrix in less than two minutes, a speed of operation before considered impossible.

These electrically heated matrix-drying tables, for hand or compressed-air pressure, as manufactured by the F. Wesel Company, 70-80 Cranberry Street, Brooklyn, N. Y., employ the well-known Westinghouse heating elements. They are in the service of some of the most progressive newspapers of the country, and have greatly improved the conditions usually found in the stereotyping rooms, besides effecting an important saving in the time of preparing the plates for the various editions.

The resistance used has proved thoroughly reliable and permanent, and the expense of electrical operation with the Westinghouse heating element is unquestionably lower than by any other method, aside from its important advantages of temperature and convenience.

For use where the element of time is not so important in drying the matrix, a slower type of heating bed is supplied. Complete with heating elements, this bed is only 2 in. in thickness and is designed to be placed directly on the steam-heated bed, making a convenient source of heat quickly available without the delay or difficulty of resorting to steam heat. These electric beds for slow drying perform their service in about the same time as the gas or steam-heated beds, and with the same economy of the quick-drying unit.

Lamp Adjuster.

The Frantz Specialty Manufacturing Company, of Sterling, Ill., is the manufacturer of the lamp adjuster, the design of which is shown in the accompanying engraving. This device provides for automatically taking up the slack in the cord and keeping it out of the way of machinery and workmen. It is made of pressed steel and the arm telescopes in three sections. The weight is less than 4 lb. Three sizes are made, namely, 6 ft., 8 ft. and 10 ft. to accommodate different heights of ceilings. The 6-ft. length is suitable for a ceiling 12 ft. in height and will adjust a lamp to any size within a radius of 3 ft. horizontally and 5 ft. vertically. In addition to the telescoping of the device, which gives considerable vertical adjustment, the lamp cord can be pulled out beyond the end of the adjuster. The slack in the cord is always taken up by a drum around which winds a clock cord attached to the lamp cord as indicated in the engraving. This drum has a spring which keeps

LAMP ADJUSTER.

the cord in tension, but it is prevented from pulling the lamp and lamp cord up by a brake which works against the drum at all times except when a person wishes to adjust the lamp. Raising on the lamp or cord releases the brake sufficiently so that the drum winds up the slack. The device has a universal joint at the ceiling so that the arm can be handled in any position and will remain there if the tension on the set screws is properly adjusted. A feature of the device is that it does not abraid or kink the lamp cord. The winding drum makes a much longer range of adjustment possible without an objectionable amount of cord hanging in the way when the lamp is at its higher adjustment.

High-Tension Entrance Tubes.

One of the important features in high-tension transmission systems is the method for bringing high-tension conductors into the station. Appreciating the demand for a reliable, convenient method, the Central Electric Company, Chicago, Ill., is placing on the market the type of entrance tube illustrated.

Fig. 1 shows an entrance tube designed for capacities up to 300 amp at 13,200 volts. This device consists of three elements, a pair of highly glazed porcelain disks, a specially designed porcelain tube and a copper conductor extending the entire length of the tube. The horizontal tube is securely fastened to the supporting disks, forming a self-contained unit substantial in construction and easy to install. The copper core is provided with terminal lugs at both ends to which the line conductors are soldered.

The construction adopted insures a weatherproof, air-tight structure with a permanently high insulation factor, and which effectually excludes rain and snow. Another feature of this

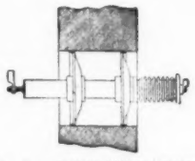


FIG. 1.—ENTRANCE TUBE.

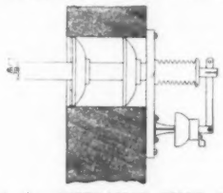


FIG. 2.—ENTRANCE TUBE AND DISCONNECTING SWITCH.

entrance tube is that it does not afford a location for bird's nests, as is more or less common with the open type of entrance. The closed construction likewise prevents insects from getting into the station.

The use of high-tension disconnecting switches is rapidly increasing, especially as their value and flexibility are being recognized. To meet the demand for a combined entrance tube and disconnecting switch the combination shown in Fig. 2 has been developed. This disconnecting switch is mounted on a 2-in. marble slab, which in turn is secured to the station wall.

By the use of this combination, the high tension can not only be safely brought into the building, but when found desirable, or necessary, the circuit can be absolutely "killed" at this point. These new entrance tubes are convenient from a construction standpoint in that it is simply necessary to leave a circular hole of the proper diameter, and after all work is completed the entrance tube can quickly be cemented in place. The construction adopted eliminates skilled labor and the personal equation, as but one thing has to be done—to place the device in position and cement the edges.

Exhibits at Chicago Telephone Convention.

At the convention of the International (now the National) Independent Telephone Association in Chicago on Dec. 7 to 9 there was the usual display of telephone apparatus in rooms at the Auditorium Hotel near the convention hall. The Automatic Electric Company, of Chicago, displayed both automatic and semi-automatic apparatus for straight-line, meter, four-party and district service, as well as a manual straight-line service. The company makes the statement that a recent canvass of subscribers having both manual (Bell) and automatic telephones showed that over 90 per cent of them were in favor of the automatic system. Particular attention was directed to the automatic traffic distributor in connection with manual equipment, designed to secure greater efficiency in manually operated telephone plants. The gentlemen in charge of this interesting exhibit included Messrs. John Meyer, W. F. Benoist, John Fisher, C. L. Fisher and John Russell.

The Kellogg Switchboard & Supply Company, of Chicago, had a large number of representatives, including Messrs. J. C. Kelsey, L. R. Foote, A. S. Hallstrom, H. N. Faris, E. G. Lawrence, G. A. Joy and J. C. Murray. The company demonstrated late ideas in ringing equipment, private-branch-exchange equipment, double supervisory, non-interfering cord circuits for magneto switchboards, and also made a representative display of apparatus and parts. It furnished automobiles to take visitors to its West Side factory.

The Stromberg-Carlson Telephone Manufacturing Company, of Rochester, N. Y., showed a full line of central-energy telephone instruments and switchboards. New types of instruments were shown, as was also a good display of intercommunicating apparatus. Messrs. W. Roy McCann, H. C. Slemin, A. Kondolf, A. M. Haubrich and others were in attendance.

The Swedish-American Telephone Company, of Chicago, showed a general line of telephones, switchboards and accessories. The radio desk telephone holder attracted particular attention. Messrs. E. B. Overshiner, A. V. Overshiner, Fred Seeley and W. O. Rhode with others represented the company.

The American Steel & Wire Company made an exhibit of such of its products as are of particular interest to telephone men, including copper, iron and steel wire, galvanized messenger strand, Crosby clips, pole steps, rubber-covered wire, etc. Messrs. Conkling, Durant, Ryder and Moeller received visitors at this exhibit.

The Holtzer-Cabot Electric Company, of Boston, had some interesting apparatus, including a multicycle set for harmonic ringing and a four-frequency vibrator which does the same work as the machine. There were also pole changers, frequency meters, both stationary and portable watchmen's clocks, desk stands and wall telephones, flexiphone, mine telephones, intercommunicating sets, ringing and charging motor-generator sets, annunciators, electric drills and small motors, both alternating-current and direct-current, for all purposes. Messrs. E. R. Harding, C. I. Hickman, F. H. Tillotson and T. G. Minema, of the Chicago office, were in charge.

Frank B. Cook, of Chicago, made a practical display of useful appliances, including protectors, cable terminals, wire joints, guy clamps, etc. Mr. Cook, himself, with Mr. J. F. Tompkins, explained the use of the appliances exhibited.

Mr. J. R. Wiley, of Chicago, represented the Standard Underground Cable Company of Pittsburg.

One of the new instruments shown at the convention was the telechronometer exhibited by the Telechronometer Company, of Rochester, N. Y. This is a time meter to record the time a telephone is used in measured service. By the use of the instrument a dial at the subscriber's station indicates the elapsed time. By an ingenious arrangement it is provided that if another subscriber listens in on a party line the meter of the eavesdropper will also register the time elapsing while he is listening in. In general, it is intended that the telechronometer shall perform a service in the telephone service akin to that of the watt-hour meter in the electric lighting and power field. It is adapted to the service of both the producer and the consumer. Messrs. Winslow Mead, of Albany, and Garrison Babcock and George Dickerson, of Rochester, were active in furthering the interests of this company.

Mathias Klein & Sons, toolmakers, of Chicago, represented by Mr. P. W. Herbst, distributed souvenir memorandum books.

The new Telephone Fire Insurance Exchange of Chicago, the co-operative insurance organization indorsed by the association, gave neat keyrings to delegates. Mr. J. B. Hoge was in charge of affairs.

The Indiana Steel & Wire Company, of Muncie, Ind., showed iron wire. Mr. E. F. Kitselman was the representative.

The Fibre Conduit Company, of Orangeburg, N. Y., exhibited a full line of fibre conduit and fittings. Messrs. W. W. Smythe, Jr., and H. M. Huffard, of the Chicago office, represented the company.

The American Electric Telephone Company, of Chicago, which has lately enlarged its force by the acquisition of Mr. W. E. Doolittle, well known in the telephone field, had a good display of switchboards, telephones and parts. The Dean Electric Company, Elyria, Ohio; the Monarch Telephone Manufacturing Company, of Chicago; North Electric Company, of Cleveland; Mungesser Electric Battery Company, of Cleveland, and others also made exhibits.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

Cold weather and the near approach of the holiday trade did something to stimulate retail business during the past week. This was more particularly noticeable in the West and Northwest than in other sections of the country, although even throughout the South distribution to consumers was accelerated. The greatest improvement was noticeable in the cities of some size, as the impassable condition of country roads did something to retard business at county seats. The strike situation in the Northwest appears to be losing its effectiveness. The flour output and the movement of grain were noticeably better during the past week. It is generally expected, however, that requests for higher wages from all railroad employees will be presented during the spring. In fact, there is evidence of unrest among all classes of skilled labor, a condition undoubtedly due to the fact that the cost of living has advanced more rapidly than the scale of wages. In the industrial world there are still heard only reports of improvement and large orders. The necessity for supplying the demand for steel has caused quite a movement in the direction of building more open-hearth furnaces. Orders, particularly for railroad material and for structural iron, continue to be phenomenally large. The mills engaged in these manufactures have their books full of orders for many months to come. Collections were rather less free last week, due possibly to the labor troubles in the Northwest and to a disposition in the South to hold cotton for even higher prices. Failures for the week ended Dec. 9, as reported by *Bradstreet's*, were 259, against 230 the previous week, 298 in 1908, 284 in 1907, 220 in 1906, and 226 in 1905.

THE COPPER MARKET.

There was a distinctly better tone in the copper market during the past week, although there was very little increase in the actual sales of metal. There seems to be a general acceptance of the proposition that, whether the great merger is formed or not, something will be done to limit the production of copper, and thereby to control the price. This is really all that interests the outside copper traders. The present unsatisfactory conditions of the market are entirely due to the adverse statistical position. With production outrunning consumption by 20 per cent, it is impossible to maintain perpetually the price of metal. While there is every reason to believe that the big amalgamation will eventually go through, even if it fails the market conditions will be improved. This situation is the result of the change in the control of the Amalgamated Copper Company. As long as H. H. Rogers was alive, no unity of interest seemed possible. The Cole-Ryan influences are operating upon exactly the opposite basis. The figures of the Copper Producers Association for November show a production of 121,618,369 lb., the highest average daily production ever known. Deliveries were 122,124,468 lb., making an apparent reduction in stocks of 506,099 lb. At the end of the month the surplus on hand in this country amounted to 153,003,527 lb. During the month of November the total visible supply in this country and Europe increased 13,796,301 lb., and on Dec. 1 was 389,861,127 lb. Exports for the present month, including Dec. 14, have been 9,336 tons. The daily call on the Metal Exchange Dec. 14 quoted standard copper as follows:

	Bid.	Asked.	Settling price.
Spot	13.00	13.25	.....
December	13.00	13.25	13.12½
January	13.12½	13.37½	13.25
February	13.12½	13.37½	13.25
March	13.12½	13.37½	13.25
April	13.12½	13.37½	13.25

The London prices on Dec. 14 were as follows:

	Noon. £	s	d	Close. £	s	d
Standard copper, spot	60	5	0	60	5	0
Standard copper, futures	61	5	0	61	5	0
Market	Firm			Steady		
Sales of spot				400 tons		
Sales of futures				1,400 tons		

Extreme fluctuations for this year:

	Highest. £	s	d	Lowest. £	s	d
London, spot	64	2	6	54	12	6
London, futures	64	17	6	55	10	0
Standard	13	45	0	12	12½	0
London, best selected	67	15	0	59	0	0

NORTHERN COLORADO POWER COMPANY.—Very encouraging reports of increased business are being made by the Northern Colorado Power Company. On Dec. 31, 1908, the company showed a deficit of about $30,000; the officials now estimate that on the same date 1909 the company will show a surplus of about $35,000, showing an improvement of $65,000 in the year. They are also confident that the surplus for the year 1910 will be above $100,000. The Northern Colorado Power Company is a combination of practically all the small power plants in the northern part of the State of Colorado, including all of the larger towns. After the consolidation a bond issue was made, and the money from that bond issue spent on the properties has brought about the improved condition. The relations of the company with the Denver Gas & Electric Company are very close, W. J. Barker, superintendent of the latter company, being president of the Northern Colorado Power Company. The country served by this company is being rapidly developed. One of the principal drawbacks to it heretofore has been the lack of water, but it has now been demonstrated that excellent water for domestic purposes, and possibly for irrigation, is available at an average depth of 30 ft. There is a fine field open for the sale of power in pumping this water.

MEETING OF THE ELECTRICAL JOBBERS.—The Electrical Jobbers' Association held a successful convention at Hot Springs, Va., last week. There were present between 200 and 300, and much benefit resulted from the intercourse and interchange of ideas and from several papers that were read and discussed before the meeting. The gathering was more of a social than a business nature. Similar meetings are held at infrequent intervals throughout the year and have a tendency to bring into closer relationship the supply dealers, jobbers, manufacturers and contractors of the country.

ELECTRIC DRIVE IN WOOLEN MILLS.—The Ayer Mills of the American Woolen Company, at Lawrence, Mass., which have been designed by Mr. Charles E. Main, mill engineer, of Boston, Mass., are now well under way. Two mill buildings, one of six stories in height and 600 ft. x 125 ft. area, and another of 330 ft. x 125 ft. area and seven stories in height, are now closed in and work is being pushed on the power station, which will have an initial capacity of 5000 kw, made up of two 2500-kw units. The entire mill installation will be electric-driven.

THEROL ELECTRIC HEATING AND COOKING SYSTEM.—Messrs. James Lawrence and J. L. Nicholson, of London, have taken an office at 30 Church street, which has been fitted with an equipment to demonstrate the merits of the Therol system for electric heating and cooking, which has attracted much attention in Great Britain since its introduction there some months ago. The system is one of heat storage, which, if generally adopted, would enable a central station to operate at 100 per cent load factor.

PIEDMONT ELECTRIC COMPANY, ANDERSON, S. C., which started business five years ago, has decided, it is reported, upon the dissolution of the company, as additional stock is required to carry out the company's plans, and it is not deemed advisable to issue such at this time. The company will, it is expected, wind up its business by Jan. 1.

CHESTER, S. C., PROPOSED ELECTRIC RAILWAY.—A report from Chester S. C., says that the advisability of constructing an electric line from Chester to Great Falls, via Richburg and Lands, S. C., is being agitated. The principal power plant of the Southern Power Company is located at Great Falls, S. C.

SUPPLIES FOR ISTHMIAN CANAL.—Bids will be opened Dec. 23 by the Isthmian Canal Commission for supplies which include a variety of electrical switches, fuses, magneto bells, fuse links, wire fixtures, rubber-covered wire, etc.

McCALL FERRY POWER COMPANY.—The sale of the property of the McCall Ferry Power Company under foreclosure, which was announced in last week's issue, practically relieves that organization of all its financial troubles and insures reorganization according to the plans originally adopted by the bondholders. The purchaser of the property was William M. Barnum, chairman of the bondholders' reorganization committee. This committee represents every outstanding bond, so that the reorganization is unanimously approved. It is probable that the new company which was formed to take over the property will be called the Southern Pennsylvania Power Company. It will have an authorized issue of $12,500,000 of 5 per cent bonds and $8,500,000 of stock. The old bondholders, according to the plan, are to receive 40 per cent in new bonds and 60 per cent in new stock for their holdings. At the present time about 300 men are at work upon the construction of a dam and power house on the Susquehanna River. The Empire Engineering Corporation is in charge of this construction work. A representative of that company says that the dam will be completed, practically, some time early in the winter, with the exception of 14 40-ft. openings. It is expected that these will be closed some time in the spring. The power house will be sufficiently completed early in January to be ready for the installation of machinery. The hydraulic machinery will be furnished by the I. P. Morris Company, Philadelphia, and the electrical apparatus by the General Electric Company. It is eventually contemplated that there shall be 10 wheels and generators, with a peak-load rating of 13,500 hp for each wheel. The initial installation will probably be not more than five of these wheels. In this connection, there has been some uneasiness felt in Baltimore lest the power company change its plans, which are now to sell energy in that city. The only information concerning this to be obtained from representatives of the company is to the effect that definite arrangements for the disposal of energy have not yet been made. It is stated, however, that no plan to abandon Baltimore has been decided upon.

WASHINGTON, BALTIMORE & ANNAPOLIS ELECTRIC LINE.—Economies which are being practised by the receivers of the Washington, Baltimore & Annapolis Electric Line will, it is stated, save the road a large amount in operating expenses next year, and it is believed that this, together with a reduction of expenses which will result from the installation of the direct-current system, will aid materially in the rehabilitation of the property. Recently the general passenger agent's department has been consolidated with that of the treasurer of the road, and there has also been a revision of the mechanical department which will result in a further reduction of operating expenses. The plan of economy is being instituted without impairing the efficiency of the road. The receivers are seeing to it that the property is being well maintained, their idea being to keep it in the best physical condition in the future. The new equipment which is to be operated under the direct-current system will be in service about Feb. 1. Five of the new cars have already arrived and are being fitted up at the shops of the company located at Annapolis Junction. More equipment will be delivered about the first of the year. It has been estimated that the operating of this new equipment under the direct-current system will reduce the expenses of the Washington, Baltimore & Annapolis over $100,000.

ATHENS, GA., PROPOSED HYDROELECTRIC DEVELOPMENT.—A company is to be formed for the development of an estimated 4000-hp water-power on the Oconee River, near Athens, among those interested being Capt. James White, J. Y. Carithers and others, of the Athens electric railway system. The power generated will be utilized in operating an addition to the Star Thread Mills at Barnett Shoals, on the Oconee, doubling the mill's capacity, while power will also be developed for a new $500,000 cotton mill to be erected. The total development will represent over a million dollars. Extensions to the Macon street railway system will furthermore be supplied with power from the new hydroelectric development, which will be one of the largest in this section of Georgia.

SEVEN-MILE HYDROELECTRIC TUNNEL.—It is reported that the engineering work which is being promoted in San Francisco by H. V. Gates, of Oregon, has no equal in the Pacific Northwest. The project is to drive a tunnel 7 miles long, tapping Pitt River and cutting off 21 miles of the rapid stream. The fall is 100 ft. to a mile and will furnish one of the biggest electric systems this side of the Rockies. He claims that when completed they will take to San Francisco 200,000 hp at a cost of not to exceed $10 per hp per annum. John Hays Hammond has, it is stated, an option on the proposed system, and is taking the survey to New York. It is estimated that the system will cost $12,000,000.

ELECTRICAL CONSTRUCTION.—Among the items printed under Construction Notes in our present issue are announcements of proposed new plants or considerable extensions of present plants at Pittsfield, Mass.; Leavenworth Kan.; St. Joe, Idaho; Wellsboro, Pa.; Charleston, S. C.; Morgantown, W. Va.; Northfield, Vt.; Slater, Mo.; Winchester, Tenn.; Sabetha, Kan.; Taunton, Mass.; Pensacola Fla.; Apache, Okla.; Richmond, Va.; Savannah, Ga.; Wichita Kan.; Sturgis, Mich.; Haskell, Tex.; Guanajuato, Mex.; Vancouver, B. C., Can.; Millvale, Pa.; Athens, Ga.; Lyons, Col.; Colorado City, Col., and Phœnixville, Pa.

ROME, GA., HYDROELECTRIC PLANT.—The Stewart-Morehead Company, of Savannah, has purchased the plant of the Raccoon Cotton Mills, at Raccoon, north of Rome, and a stock company will be formed to carry out the company's plans to develop an available water-power where electricity will be generated to run the mill and to sell to nearby towns and consumers for lighting and other purposes. The machinery of the Raccoon mills will be changed, the plans calling for a 5000-spindle mill.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY.—W. C. Webster, the sales manager of the New York office of the Westinghouse Electric & Manufacturing Company, has resigned his position, to take effect Dec. 15. He will be succeeded by Walter S. Rugg, who has been connected with the general engineering department and in charge of the sales department of large lighting interests. Mr. Webster has been with the Westinghouse Electric & Manufacturing Company for about 12 years. He is not ready to announce his future plans at this time.

MERGING OF BELT-CONVEYOR COMPANIES.—It is announced that a rearrangement of the management of the Robins New Conveyor Company has been effected, and a merger of that company will shortly take place with the Robins Conveyor Belt Company. At the meeting of stockholders of the company the following were elected as the board of directors: J. I. Atterbury, C. Kemble Baldwin, Harold Binney, H. J. Cook, Pierre Jay, Alvin W. Krech, Thomas Robins and Albert C. Wall.

RAILROAD ELECTRIFICATION AT CHICAGO.—The railroads have informed the local transportation committee of the City Council that the Illinois Central is the only road which has seriously considered electrification, and that it has decided that the electrification of freight terminals is impracticable. The proposition was considered with a view to the third rail and also to overhead trolley. The railroad companies also informed the committee that they know of no fuel in which the smoke can be entirely eliminated.

BRITISH COLUMBIA 20,000-HP TRACTION POWER HOUSE.—General Manager R. H. Sperling, of the British Columbia Electric Railway Company, on his return from England on Dec. 7, announced that the directors had passed a $6,000,000 appropriation for improvements to the company's system. One large work to be immediately undertaken will be the erection of a 20,000-hp steam auxiliary plant in Vancouver.

TELEPHONES ON THE ILLINOIS CENTRAL.—The Illinois Central Railroad Company has now 2216 miles of its road equipped with telephones, extending from Chicago to Omaha, from Indianapolis to St. Louis, and also in the neighborhood of New Orleans. These telephones practically cover every mile of main track of the railroad.

B. R. T. LINE TO JAMAICA.—The Brooklyn Rapid Transit Company will soon start work on the construction of a new trolley line through Utica Avenue and Avenue N to Jamaica. The new line will be about four miles long, and will serve as an extension of the present Reid Avenue line.

HAMMON ENGINEERING COMPANY.—The Hammon Engineering Company, of San Francisco, which is interested in power development work, has recently been incorporated with a capital stock of $1,000,000 by W. P. Hammon, A. E. Boynton, N. Cleveland, C. U. Black and C. S. Goodrich.

IMPROVEMENTS AT ALLIS-CHALMERS PLANT.—The additions and alterations to the plant of the Bullock Electric Manufacturing Company in Cincinnati, referred to in these columns Nov. 11, consist of a new storeroom, additional story to shop No. 2, extension to foundry, impregnating house, crane runways to shops Nos. 1 and 3, increasing the boiler capacity and installing a new air compressor. The new storeroom will be 303 ft. long by 29 ft. wide, with a 2-ton, electric-travel, eight-crane runway the full length; shop No. 2 will have an additional floor, 303 ft. long by 100 ft. wide. The present impregnating plant located in shop No. 2 will be installed in a special building of fireproof construction, connected to the adjoining shops by an elevator and bridges. The extension to the foundry will be 200 ft. long by 103 ft. wide. These various buildings have concrete foundation walls, brick superstructure, steel columns, trusses, etc. In shop No. 3 there will be an additional electric-crane runway and mezzanine floor 200 ft. long. The boiler capacity will be increased with four 300-hp boilers. There will also be installed a steam-driven air compressor, with a capacity of 500 cu. ft. per minute.

WINNIPEG ELECTRICAL MACHINERY CONTRACT.—We are informed by the Power Construction Department of the city of Winnipeg, Man., that an item which appeared in these columns in the issue of Dec. 2, concerning the award of a contract for electrical machinery, is incorrect. No award was made to the company named, which did not bid on the machinery of the Winnipeg generating station, and tenders have not yet been called for the equipment of the terminal station. Our news was obtained from a Canadian correspondent, who reported the item from a Canadian newspaper.

PHŒNIXVILLE (PA.), VALLEY FORGE & STAFFORD ELECTRIC RAILWAY COMPANY.—A company which was recently organized in Pennsylvania, known as the Phœnixville, Valley Forge & Stafford Electric Railway Company, has perfected plans for building a 10-mile electric line from Phœnixville to Stafford. The power plant and repair shops will be located at Valley Forge.

ROME WIRE COMPANY.—The Wire & Telephone Company of America, Rome, N. Y., will after Dec. 14 be known as the Rome Wire Company. In announcing the change of name the company states that the adoption of the new name was prompted by the fact that its manufacturing facilities are devoted exclusively to the manufacture of electrical wires, while pride in the industrial growth of Rome also entered as a factor.

CHICAGO, PEORIA & ST. LOUIS RAILWAY.—Plans are being prepared to change the motive power of the Chicago, Peoria & St. Louis Railway Company, known now as the "Bluff Line," from steam to electricity. The company is now in the hands of a receiver, but it is understood that it will be taken over by a syndicate of Illinois capitalists and converted into an electric line. The road is about 200 miles in length.

SAVANNAH (GA.) HYDROELECTRIC CONSTRUCTION COMPANY.—A new organization has been formed at Savannah, Ga., entitled the Savannah Hydro-Electric Construction Company, which proposes to construct a hydroelectric power plant on the Connooche River, 40 miles from Savannah. The capital stock of the new company is $300,000.

ELECTRIFICATION IN OAKLAND, CAL.—The Southern Pacific Railroad Company, through the name of the Central Pacific, has applied to the Board of Supervisors of the city of Oakland, Cal., for permission to equip about four miles of its track with electricity and also for a 50-year franchise to operate a double-track railway from Melrose to Stanley Road.

Financial Intelligence.

THE WEEK IN WALL STREET.

The moderate trading last week in Wall Street was of healthy tone and conservative temper. The business-like message of President Taft had a reassuring effect in the financial world, and, while it was followed by no particular boom in securities, there were general advances in the market, and legitimate buying was in evidence all through the list. The physical conditions of trade, of the industries and of the railroads are so satisfactory that there is no reason for Wall Street to be alarmed. During the spring and summer the prices of securities were pushed entirely too high to be on a parity with the condition of business. For the past two or three months the stock market has paused, and has been permitting commercial business to catch up. It is not likely that there will be soon any speculative movement which will carry prices far out of line. The demands of trade have stiffened up the money market to a position where speculation is not as easy as it was six months ago. The Wall Street prospect for the immediate future is for fair business upon a conservative basis. During the past week the money market, both at home and abroad, has been entirely satisfactory. Foreign banks have shown no disposition to increase rates of discount, and loans have been made by American bankers at about the same old level. Rates for money Dec. 14 were: call, 4@5 per cent; 90 days, 4¾ per cent. The quotations in the table are those of the close, Dec. 14.

NEW YORK.

	Dec. 6.	Dec. 14.	Shares sold.		Dec. 6.	Dec. 14.	Shares sold.
All.-Ch.	15½	15½	2,800	Int.-Met.,pfd.	58¼	61⅝	98,550
All.-Ch., pfd.	55¼	53¾*	2,925	Mackay Cos.	92½	91½	1,100
Amal. Cop.	86¼	88⅛	184,600	MackayC.,pfd.	77⅛	76¼	700
Am. D. T.	20½*	20½*	———	Man. Elev.	139⅛	140½*	632
Am. Loc.	60¾	61¾	4,850	Met. St. Ry.	23*	23*	1,563
Am. Loc., pfd.	114¾	114	305	N.Y.&N.J.Tel.	139¼*	139¼*	———
Am. Tel. & C.	83*	80	———	Steel, com.	89⅜	91⅞	723,320
Am. T. & T.	140	143	37,381	Steel, pfd.	124½	125½	7,770
B. R. T.	81⅞	80¼	83,485	W. U. T.	78¼	78½	9,530
Gen. Elec.	160	160½	3,000	West'h., com.	84½	84	5,400
Int.-Met.,com.	24⅜	24⅝	115,685	West'h., pfd.	134*	135*	300

PHILADELPHIA.

	Dec. 6.	Dec. 14.		Dec. 6.	Dec. 14.
Am. Rys.	45⅛*	47	Phila. Elec.	13½	13½
Elec. Co. of A.	12⅜*	12⅜*	Phila. R. T.	27½	28⅛
Elec. St. B'ty.	57	57¼	Phila. Trac.	88½*	88¾
E. S. B'ty, pfd.	30*	30*	Union Trac.	53¾	52½

CHICAGO.

	Dec. 6.	Dec. 14.		Dec. 6.	Dec. 14.
Chi. City Ry.	180*	180*	Chi. Tel. Co.	135	136
Chi. Rs., Ser. 1.	98*	100	Met. El., com.	17*	18
Chi. Rs., Ser. 2.	30¾	30	Met. El., pfd.	51½	56
Com. Edison.	117	118	Nat'l Carbon.	97½	105
Chi. Subways.	4½	5⅛*	Nat'l Car., pfd.	120*	123*

BOSTON.

	Dec. 6.	Dec. 14.		Dec. 6.	Dec. 14.
Am. T. & T.	140⅛	143⅛	Mex. Tel.	2¾*	2½
Cum. Tel.	145⅞*	145⅞*	Mex. Tel., pfd.	6*	5½
Edison E. Ill.	250	250	N. E. Tel.	134¾	136¼
Gen. Elec.	160½	160⅞*	W. T. & T.	12*	12
Mass. E. Ry.	15½	15⅞	W. T. & T., pfd.	90*	89½
Mass. E. R., pfd.	76¼	77½			

* Last price quoted.
Shares sold are for week of Dec. 6 to Dec. 11.

COPPER COMPANIES CONSOLIDATED.—Arrangements for the merger of the Nevada Consolidated Copper Company, the Utah Copper Company and the Boston Consolidated Copper Company have been practically completed, and official announcement giving the terms of the deal is expected at any time. These three companies have a production of close to 150,000,000 lb. of copper per year, and the earning power of the merged company, based on 15-cent copper, will be about $10,000,000 a year. It is stated that this consolidation is the first step toward an amalgamation of the Cole-Ryan, Guggenheim and Amalgamated properties. Samuel Untermyer, attorney for the Boston Consolidated Copper Company, declares that the present merger has no connection with the more extensive consolidation that is being discussed. It is stated that the promoters of the great consolidation laid their plans before President Taft last week and succeeded in convincing him that the proposed merger would not be in violation of any law.

RUMOR OF STANDARD OIL IN TELEPHONE COMPANIES.—It is rumored in Pittsburgh that Standard Oil Company interests have financed the merging of the independent telephone companies of Pennsylvania and the Central West into the Continental Telephone & Telegraph Company, which was recently incorporated in New Jersey with a capital of $50,000,000. These reports originated from the fact that John G. Splane, vice-president and general manager of the Pittsburgh & Allegheny Telephone Company, one of the principal properties which have gone into the merger, was formerly an official in the Standard Oil Company and has always been closely identified with Standard Oil interests. His brother, W. W. Splane, for a number of years was general manager of the telegraph department of the Standard Oil Company, and it is also pointed out as significant that wherever the Standard Oil Company has obtained the right to lay pipe lines, it has also obtained the right to erect poles along the same right-of-way.

CENTRAL COLORADO POWER COMPANY MORTGAGE.—A second mortgage, aggregating $1,350,000, has been filed in Denver covering the real estate and chattels of the Central Colorado Power Company. It is drawn in favor of the Knickerbocker Trust Company of New York. The mortgage runs until 1929 and bears 5 per cent interest.

JAMESTOWN, N. Y., CENTRAL-STATION PROPERTY SOLD.—Following the recent special taxpayers' election in Jamestown, N. Y., at which the voters rejected the proposal to purchase the Jamestown Lighting & Power Company, comes the announcement that the capital stock, franchise and property of that company have been sold to A. N. Broadhead and associates, who control the Chautauqua Traction Company and the Jamestown Street Railway Company. The price paid was $90,000, which was the sum for which the plant was offered to the Board of Lighting Commissioners of Jamestown, to be incorporated with the municipal plant, but which the taxpayers refused to pay by a small majority. The company has a 50-year franchise, granted about 23 years ago. It is possible that by combining the electric light and power service with the street railway a sufficient demand for electricity may be created in Jamestown to make it profitable to use power transmitted from Niagara Falls. The Niagara power is already transmitted to Dunkirk, and if brought into Jamestown it will be delivered to the Chautauqua Traction Company's station at Mayville and there reduced in voltage for distribution throughout Jamestown. Ultimately the two local plants will be combined in the street railway power house near the boat landing in Jamestown. The Jamestown Light & Power Company is the successor of a company organized in 1887. The business progressed satisfactorily for a number of years, but declined after the establishment of a municipal plant. However, the company was reorganized, and of late years the business has considerably increased. A majority of the stock and bonds of the company was held by the United Electric Securities Company, of Boston.

WESTERN UNION TELEGRAPH COMPANY.—At the meeting of the directors of the Western Union Telegraph Company last week, the majority of the Gould representatives were retired from the board, and their places were filled by men representing the American Telephone & Telegraph Company. This is the natural sequence of the purchase of the Gould holdings by the big telephone company. The only members of the old régime who remain on the board are George J. Gould, Edwin Gould and J. J. Slocum, the latter representing the Russell Sage interests. Robert C. Clowry, the president of the company, remains on the board. The new directors elected were: Theo. N. Vail, president American Telephone & Telegraph Company; Edward J. Hall, vice-president American Telephone & Telegraph Company; Henry S. Howe and John I. Waterbury, directors American Telephone & Telegraph Company; Union H. Bethel, president New York Telephone Company; Henry B. Thayer, president Western Electric Company; Henry P. Davidson, of J. P. Morgan & Company; Robert S. Lovett, Harriman Estate; William H. Moore, United States Steel Corporation, and Robert Winsor.

QUEBEC RAILWAY, LIGHT, HEAT & POWER COMPANY.—The American Light & Traction Company has finally disposed of its holdings in the Quebec-Jacques Cartier Electric Company to the newly organized Quebec Light, Heat & Power Company. This practically completes the monopoly by the newly formed company of the public utilities in Quebec and the adjacent territory. The Cartier company was the last one to hold out against absorption. The underwriting of the bonds proposed to be issued by the new company has been very successful, there having already been underwritten $3,700,000 out of an issue of $4,000,000. Edward A. Evans, chief engineer of the Quebec Railway, Light & Power Company, has received instructions to prepare and revise the plans already made in connection with the building of the Quebec & Saguenay Railway from St. Joachim to Murray Bay. Mr. Evans is now engaged in making arrangements for the final survey and estimates for this work, which it is expected will be started next year.

CONTINENTAL TELEPHONE & TELEGRAPH COMPANY.—The business of acquiring control of independent telephone lines throughout the Middle West seems to be continued with fair success on the part of the Continental Telephone & Telegraph Company. Last week the new corporation acquired control of the American Union Telephone Company of Pennsylvania, which operates throughout the entire State of Pennsylvania, except in the cities of Philadelphia and Pittsburgh, and which also reaches over to New York, West Virginia and Maryland. This last acquisition gives the Continental company practically control of all the independent telephone lines operating east of the Ohio River from northern New York to West Virginia. John A. Howard, of Wheeling, who is president of the Continental company, is the active man promoting the merger of these enterprises. All of the officials of the new company are men who have been interested in independent telephone lines throughout Pennsylvania and West Virginia.

CHICAGO SUBWAY REORGANIZATION.—While all of the plans of the reorganization committee of the Chicago Subway Company have not as yet been announced, it is understood that the present $17,000,000 of bonds which are in the hands of the public will be converted into preferred stock, or into an income bond. In either case the new securities will be noncumulative as to dividends. In order to take care of the company's floating debt and to furnish capital to perfect the freight-carrying department, there will be a new first mortgage bond issued. The amount of these bonds will probably be about $13,000,000, and they will probably go to the Armour and Harriman interests, who are the chief holders of the floating debt. There is also proposed, in a tentative way, an assessment of $10 a share on the old stock. The members of the reorganization committee assert that with the proper financial basis the property could become a good earner.

SHAWINIGAN POWER COMPANY.—The stock of the Montreal Light, Heat & Power Company took on another upward trend during the past week on the Montreal Stock Exchange. It was reported that J. E. Aldred, president of the Shawinigan Water & Power Company, was to take the place of the late Mr. W. McLea Walbank on the directorate of the Montreal Power Company, thus emphasizing more clearly the close relations between the two companies, announcement of which was published Dec. 2. Messrs. R. Forget, M. P., and J. N. Greenshields, K. C., directors of the Montreal Power and Shawinigan Power companies, respectively, both deny that there is any intention, so far as they know, of completing a merger of the two companies.

CHICAGO UNITED RAILWAY COMPANY.—The first step toward the reorganization of the Consolidated Street Railway Company of Chicago, which is in the hands of a receiver, was taken at Springfield, Ill., last week, when a license was issued for the incorporation of the Chicago United Railway Company. This company was formed by the bondholders' committee of the Consolidated Company, and it plans to ultimately take over all of the old lines which are now known as the Yerkes properties. The nominal capital of the new company is $100,000, but this will be increased as necessity demands.

PHILADELPHIA COMPANY STOCK DIVIDEND.—It was announced last week that the Philadelphia Company, of Pittsburgh, is about to issue at par, to both the preferred and common stockholders, 55,200 shares of common stock. This distribution of surplus was foreshadowed upon the ticker when transactions in the stock appeared Dec. 8. Sales were made at 103, a price which was 20 points higher than the last previous sale recorded in the stock exchange, which was in 1903.

SACRAMENTO VALLEY POWER COMPANY.—A deed of trust has been executed to the Central Trust Company, of San Francisco, Cal., by the Sacramento Valley Power Company, mortgaging the property to secure an issue of $500,000 of new bonds, the proceeds of which will be used for extensions and improvements. The company operates three power plants in Shasta County, California, with a system of transmission lines extending through the Sacramento Valley.

NEW ENGLAND TELEPHONE & TELEGRAPH COMPANY.—The report of the New England Telephone & Telegraph Company, which has just been filed with the Highway Commission of Massachusetts, shows gross earnings for the year ending June 30, 1909, of $11,031,289, an increase of $577,305. The net earnings were $2,724,816, an increase of $336,500. The number of stockholders were 3832, 89 per cent of whom live in Massachusetts.

BOSTON & EASTERN ELECTRIC COMPANY.—A petition has been filed with the Railroad Commissioners of Massachusetts by the directors of the Boston & Eastern Electric Company asking for such legislation as may be necessary to enable the company to construct a tunnel underneath Boston Harbor. The idea is to bring the proposed road into a terminal to be constructed under Post Office Square, in Boston.

PACIFIC TELEPHONE & TELEGRAPH COMPANY.—The Pacific Telephone & Telegraph Company, of San Francisco, had on Oct. 1 a total of 349,119 telephone stations, an increase of 31,607 stations since the first of the year. This is an increase of almost 10 per cent within nine months, and indicates how rapidly the company is growing.

INDEPENDENT TELEPHONE STOCK DEAL.—F. H. Goff, president of the Cleveland Trust Company, testified at a hearing in that city last week that he had taken options upon 19,000 shares of the stock of the United States Telephone Company to New York City and offered the block to officials of the American Telephone & Telegraph Company. These officials declined to purchase, but introduced Mr. Goff to a member of the firm of R. L. Day & Company, brokers, who agreed to buy the 19,000 shares. Mr. Goff says that a contract was made by which the purchaser would pay $40 a share for the common stock and $80 a share for the preferred stock. Mr. Goff said that he met in the office of Day & Company, James S. Brailey, Jr., who, it has been said, has recently acquired control of the United States Telephone Company. For several weeks there have been rumors that the Bell interests through the United States company had acquired control of the principal independent telephone properties in the Middle West. These rumors have been denied by Mr. Brailey.

ELECTRICAL UTILITIES CORPORATION.—The formation of a new holding company, known as the Electrical Utilities Corporation, which was announced in the last issue, gives to the General Electric Company four of these financial corporations. The new concern will have a capital of $7,500,000, and will be devoted almost entirely to the financing of electrical companies, rather than to the operation. In addition to the new concern, the General Electric Company now controls the United Electric Securities Company, of Boston, the Electrical Securities Corporation and the Electric Bond & Share Company, of New York. It is said that these financial companies have been of great service to the General Electric Company in enabling the manufacturing company to accept the securities of light, power and traction companies which were not prepared to pay for apparatus in cash, and to market them successfully.

INCREASE IN COMMONWEALTH EDISON COMPANY STOCK.—At the recent annual meeting of the Commonwealth Edison Company, of Chicago, as previously noted in these columns, the authorized capital stock of the company was increased from $30,000,000 to $40,000,000, the $10,000,000 of new stock to be issued at the discretion of the directors. The first installment of this new issue, $3,000,000, has now been announced by the directors. It will be offered to present stockholders at par on Feb. 1, each stockholder being allowed 10 per cent of present holdings. The first payment of 25 per cent for the stock will be due on that date, and remaining installments of equal size will be payable on May 2, Aug. 1 and Nov. 1, 1910.

RICHMOND, VA., MUNICIPAL PLANT BOND ISSUE.—Upon the recommendation of the finance committee of the city of Richmond, Va., the Common Council has voted an additional sum amounting to $65,000 to be used in the construction of the distributing system of the new municipal electric lighting plant, now in course of completion. This is in addition to $250,000 bonds, the proceeds of which are for paying for the electric plant proper, and $100,000 for water pumps to be electrically driven by power from the new power house. At the same meeting several minor contracts for parts of the electric system were approved. The total thus far authorized is $415,000.

JACKSON (MISS.) ELECTRIC RAILWAY, LIGHT & POWER COMPANY.—F. B. Trout and H. H. Corson, Nashville representative of the General Electric Company, together with some local capitalists, have taken over the plant and holdings of the Jackson Electric Railway, Light & Power Company. The price paid for the property was approximately $1,000,000. The company operates about seven miles of track and furnishes energy for electric street lighting. The General Electric Company, according to its officials, has nothing to do with the deal.

CONSUMERS' ELECTRIC COMPANY OF NEW ORLEANS.—Plans are being formulated by the bondholders of the Consumers' Electric Company of New Orleans for a reorganization to take the property out of the hands of the receiver. It is proposed that a new company be formed to take over the plant. The business of the company has increased under the administration of the receiver, and it is necessary to enlarge the plant, which, together with other improvements, will require an expenditure of about $1,000,000. Samuel Insull, president of the Commonwealth Edison Company, of Chicago, is receiver.

THIRD AVENUE RAILROAD COMPANY.—The stock of the Third Avenue Railroad Company sold as low as 12¼ on the exchange last week. This is taken to be a speculator's estimate of what the stock will be worth under the most recent reorganization plan. The latest plan proposes an assessment of $45 per share. It is said that the Interborough-Metropolitan Company practically sold out all of its holdings in the Third Avenue Company some time ago, when the price was much higher than it is at present.

COMMONWEALTH EDISON COMPANY.—It has been announced in Chicago that the Commonwealth Edison Company would sell $3,000,000 of the recently authorized $10,000,000 of new capital stock at par. This offering will be made to the present stockholders of the company on Jan. 20. Payments are to be made in quarterly installments. The balance of the authorized issue will be put out as the developments of the company require.

DIVIDENDS.

American Telephone & Telegraph Company, quarterly, 2 per cent, payable Jan. 15.

Butte (Mont.) Electric & Power Company, quarterly, 1½ per cent, payable Jan. 3.

Duluth-Superior (Minn.) Traction Company, quarterly, 1 per cent, payable Jan. 3.

Electrical Securities Corporation, semi-annual, 4 per cent, payable Jan. 3.

El Paso (Texas) Electric Company, semi-annual, 3 per cent, payable Jan. 10.

Manhattan Railway Company, quarterly, 1¾ per cent, payable Jan. 3.

Sao Paulo (Brazil) Tramway, Light & Power Company, quarterly, 2½ per cent, payable Jan. 1.

Toronto (Ont.) Railway Company, quarterly, 1¾ per cent, payable Jan. 3.

Twin City Rapid Transit Company, preferred, quarterly, 1¾ per cent, payable Jan. 2.

Union Railway Gas & Electric Company, quarterly, 1½ per cent, payable Jan. 3.

Union Traction Company, Philadelphia, semi-annual, 3 per cent, payable Jan. 1.

United Gas Improvement Company, Philadelphia, quarterly, 2 per cent, payable Jan. 15.

United Traction & Electric Company, Providence, R. I., quarterly, 1¼ per cent, payable Jan. 1.

Utah Consolidated Copper Company, quarterly, 10 per cent, payable Jan. 15.

Western Union Telegraph Company, quarterly, ¾ per cent, payable Jan. 15.

Wilkes-Barre (Pa.) Gas & Electric Company, quarterly, 1¼ per cent, payable Jan. 1.

REPORT OF EARNINGS.

	Gross earnings.	Expenses.	Net earnings.	Charges.	Surplus.
Boston Suburban Electric Companies:					
Year ended Sept. 30, 1909	$243,597	$44,347	$199,249	$146,382	$52,867
Year ended Sept. 30, 1908	223,530	46,307	177,222	35,339	141,883
Fairmount Park Transportation Company, Philadelphia:					
Year ended Oct. 31, 1909	141,637	67,983	73,654	49,400	24,254
Year ended Oct. 31, 1908	145,543	69,681	75,862	47,540	28,321
St. Joseph (Mo.) Railway, Light, Heat & Power Company:					
November, 1909	82,296	42,335	39,961	21,608	18,353
November, 1908	75,963	30,777	39,186	20,992	18,194
Schenectady Railway Company:					
Quarter ended Sept. 30, 1909	296,163	160,017	136,146	23,809	102,947
Quarter ended Sept. 30, 1908	264,272	169,114	95,158	26,780	63,670
United Traction Company, Albany, N. Y.:					
Quarter ended Sept. 30, 1909	554,360	312,803	241,557	94,732	163,859
Quarter ended Sept. 30, 1908	520,679	302,187	218,492	70,140	159,630
Westchester Electric Railroad Company:					
Quarter ended Sept. 30, 1909	149,255	99,378	49,876	14,970	35,069
Quarter ended Sept. 30, 1908	111,614	125,768	*14,153	17,549	*31,549

* Deficit.

GENERAL NEWS

Construction News.

BIRMINGHAM, ALA.—The charter of the Birmingham & Gulf Railroad Company, recently incorporated, includes the privilege of operating street railway and general electric railway systems. J. M. Dewberry is first vice-president, and R. D. Johnston, Jr., secretary.

JACKSONVILLE, ALA.—Plans are being made for the construction of a large weaving mill in Jacksonville. The entire plant will be operated by electricity. George P. Ide and associates are interested in the enterprise.

BENSON, ARIZ.—The Benson Lighting Company is reported to be contemplating the installation of an electric light plant to furnish electricity in Benson.

WHITE CLIFFS, ARK.—It is reported that a 3000-bbl. plant, equipped with 150 kilns, will be erected on the property of the White Cliffs Portland Cement Company, which has been acquired by large financial interests, plans for which are being prepared. It is proposed to operate the machinery by electricity, which may be supplied from a hydroelectric development on the Red River, if gas engines are not installed.

BAKERSFIELD, CAL.—It is reported that the West Side Electric Company has decided to install a 600-kw generator instead of a 300-kw, as originally planned.

BEAUMONT, CAL.—The Beaumont Gas & Power Company has petitioned the Board of Supervisors for a franchise to construct and operate an electric and gas lighting system. The project will include the erection of power house, poles and pipe lines. Bids will be received by the Board of Supervisors for the franchise until Dec. 22. A. B. Pilch is county clerk.

BIG PINE, CAL.—The Buckeye Mining & Smelting Company has placed orders with the Allis-Chalmers Company, Milwaukee, Wis., for hydroelectric apparatus for its plant at Big Pine, Cal. The equipment consists of a horizontal turbine directed to a 300-kw, three-phase, 60-cycle, 2300-volt alternator and a 15-kw, 120-volt, motor-driven exciter set.

CASTELLA, CAL.—E. C. Newell and J. G. Cunningham, large stockholders of the Castle Lake Lumber Company, of Castella, have filed on three water-right locations aggregating 40,000 in. of the water running into Echo Lake, west of Castella. The water will be diverted through ditches and flumes, where it will be developed to generate electricity.

COALINGA, CAL.—The Coalinga Water & Light Company, recently incorporated, is making preparations to extend its electric service and water system into Coalinga. The transmission line will be extended from Lemoore. A. G. Wishon, manager of the San Joaquin Light & Power Company, of Fresno, Cal., is interested in the company.

EL PORTAL, CAL.—Extensive improvements are contemplated at the Hite Cove Mine, located on the south fork, near El Portal, during the coming year, which include enlarging the water-power plant, the installation of a larger dynamo and doubling the capacity of the stamp mill.

KING CITY, CAL.—Notice of appropriation of a power site on streams in the Coast Range, west of King City, has been filed by C. P. Baird, engineer, of King City, Cal.

LOS ANGELES, CAL.—The Home Telephone Company is preparing to establish four new exchanges in Los Angeles and proposes to double the capacity of the downtown cable system.

LOS ANGELES, CAL.—The City Council has adopted the resolution to issue $3,500,000 in bonds, the proceeds to be used for the construction of a municipal electric plant in connection with the Owens River project. H. J. LeLande is city clerk.

OAKLAND, CAL.—In connection with its plans to equip its suburban service for electrical operation, the Southern Pacific Railroad Company has applied to the Board of Supervisors in the name of the Central Pacific Railway Company for a 50-year franchise to operate a double-track railway from Melrose to Stanley Road, a distance of about four miles. From Stanley Road the railway will extend through San Leandro to Hayward.

REDDING, CAL.—The Sacramento Valley Power Company, which operates three power plants in Shasta County, with a system of transmission lines extending into the valley, has executed a deed of trust to the Central Trust Company, of San Francisco, Cal., to secure an issue of bonds to the amount of $500,000, the proceeds of which will be used for extensions to its system to various points in the Sacramento Valley.

SANTA CRUZ, CAL.—The advisory committee of the Council has recommended extending and improving the city lighting system, installing a uniform system and fixtures. An issue of bonds to the amount of $250,000 is favored.

SHINGLETON, CAL.—The Northern California Power Company has recently filed on two water locations, one for 1500 cu. in., flowing from Lava Springs into the creek, and 2000 cu. in. at another point. The water is to be diverted in turn to the Volta power house, thence to the South power house and finally to the power house at Inskip, in Tehama County.

COLORADO CITY, COL.—Plans are being considered for the construction of a new electric light and power plant in Colorado City. Stanley S. Effinger, of the firm of Effinger & Dunbar, is interested in the project.

DENVER, COLO.—It is reported that the transmission line of the Central Colorado Power Company between the Shoshone tunnel and Denver, which was badly damaged by the recent heavy snow storms, will have to be entirely rebuilt. The line cost in the neighborhood of $1,500,000 and furnished electricity to the Denver Gas & Electric Company from the Shoshone power tunnel, located near Glenwood Springs. The line had been in operation about two months.

GREELEY, COL.—The Greeley Street Railway Company, it is said, will petition the City Council for a franchise to furnish electricity for lamps as well as for street car service.

LYONS, COL.—R. W. Jones has filed on a reservoir site and pipe line on the North St. Vrain for power purposes. The reservoir will be located on the Billings Ranch and the water conducted by a 54-in. pipe to Lyons, about six miles distant, where the proposed power house is to be located. The estimated cost of the diversion dam is $36,000, and of the pipe line $60,000.

TRINIDAD, COL.—Plans are being considered by the Southern Colorado Power & Railway Company for a large power development, including a chain of electric plants extending along the Sangre de Cristo and Culebra ranges, if the present plans for reorganization are consummated. It is also proposed to extend the traction lines of the company.

BRIDGEPORT, CONN.—Preparations are being made by the Connecticut Company for the erection of an addition to its power house 120 x 42 ft., in which additional equipment will be installed. The cost of the extension is estimated at $20,000.

COLCHESTER, CONN.—Plans are being made by the National Electric Shoe Company for the installation of its proposed electric light plant. A 75-kw generator will be installed at first and a larger one later on.

EAST NORWALK, CONN.—The district committee has authorized the extension of the electric transmission lines from Gregory Boulevard to Marvin Ridge.

HARTFORD, CONN.—It is reported that the new syndicate, formerly the Northern Connecticut Power Company and the Enfield Power Company, has offered to purchase the hydraulic rights of the Connecticut River Power Company at Windsor Locks for $400,000.

NORWICH, CONN.—The Falls Company has installed two water wheels at its dam on the Yantic River and will erect a power house for the electric generators, which will supply electricity to operate its mills. The plant will have an output of about 200 hp.

DOVER, DEL.—The Delaware Central Construction Company, recently incorporated for the purpose of constructing an electric railway between Delaware City and Dover, it is said, proposes to take over the option on the rights-of-way for such a railway, which have been held by various companies. Dr. Thomas O. Cooper, of Wilmington, Del., is reported to be interested in the enterprise.

JACKSONVILLE, FLA.—The city is advertising for bids for lighting the streets and public buildings by electricity or gas for a term of one year, beginning Jan. 1, 1910. J. M. G. Carrera is city clerk.

MULBERRY, FLA.—The Prairie Pebble Phosphate Company, of Mulberry, Fla., is planning to make improvements to its power plant, including the installation of a new electric generating unit rated at about 500 hp.

PENSACOLA, FLA.—Arrangements have been made between the Bullock & Caldwell Real Estate Company and the Pensacola Electric Company for the construction of an electric railway to the Lakeview property.

PENSACOLA, FLA.—The Pensacola Electric Company is reported to be contemplating the installation of a 300-kw motor generator set and a 500-kw turbo-generator set. Stone & Webster, of Boston, Mass., are general managers.

ATHENS, GA.—Plans are being made to form a company for the purpose of constructing a hydroelectric plant on the Oconee River, near Athens. It is estimated that 4000 hp can be developed, which will be utilized to operate an addition to the Star Thread Mills at Barnett Shoals, and also for a new $500,000 cotton mill to be erected. The company will also furnish electrical power to operate the Macon street railway system. Captain James White, J. Y. Carithers and others are interested in the enterprise.

BREMEN, GA.—The contract for the installation of the municipal electric light plant has been awarded to McCrary & Company, of Atlanta, Ga. It is expected to have the plant ready to put in operation by Dec. 25.

COLUMBUS, GA.—The State Railroad Commission has ordered a material reduction in the rates charged for gas and electricity supplied by the Columbus Electric Company. Under the decision of the commission the prices for electricity for lighting purposes are fixed at from

10 cents to 5 cents per kw-hour, according to amount consumed, which is a reduction of from 10 to 15 per cent on the present rates. The price for arc lamps is placed at $60 per lamp per year and $24 per year for incandescent lamps of 32 cp for street lighting purposes. The rate for gas is reduced from $1.75 to $1.35 per 1000 cu. ft.

CORDELE, GA.—Application has been made for a charter by D. G. Zeigler, of St. Matthew, S. C.; H. S. Marshall, of Illinois; G. W. Hatcher, of Cordele, Ga., and others, for a company to be capitalized at $1,000,000, which proposes to construct a hydroelectric plant on Flint River. The present plans calls for the development of 9000 hp for electric transmission to Cordele and Americus.

ROME, GA.—The Stewart-Morehead Company, of Savannah, Ga., has purchased the Raccoon Cotton Mills at Raccoon, Ga., north of Rome. It is said that a company will be formed to operate the mills and develop an available water power to generate electricity to run the mill. The company will also furnish electricity to nearby towns for lamps and for commercial and industrial purposes.

SAVANNAH, GA.—The Savannah Hydro-Electric Construction Company, recently incorporated, proposes to construct a hydroelectric power plant on the Connooche River, 40 miles from Savannah. D. G. Zeigler & Company, of Jacksonville, Fla., are engineers in charge of the work.

BOISE, IDAHO.—Arrangements are being made by the Boise & Interurban Railroad Company to equip its Idaho Street city line from Seventh Street to Avenue A, to be operated by electricity, which will also be extended to the penitentiary grounds. W. E. Pierce is president of the Company.

MONTPELIER, IDAHO.—The Bear Lake Power Company has contracted with the Allis-Chalmers Company, Milwaukee, Wis., for the following equipment for its plant: One hydraulic turbine direct-connected to a 650-kw, 60-cycle, three-phase, 6600-volt generator and a 15-kw, 120-volt motor-driven exciter.

ST. JOE, IDAHO.—It is reported that contracts will soon be awarded by the Chicago, Milwaukee & Puget Sound Railroad Company for the construction of two electric power plants in the Bitter Root Mountains to furnish electricity to operate its railroad over the Idaho division, between St. Joe, Idaho, and St. Regis, Mont., a distance of over 100 miles. The two plants will develop 30,000. One will be located on the St. Joe River, at St. Joe, Idaho, and the other on the Missoula River, about 40 miles below Missoula, Mont.

JERSEYVILLE, ILL.—The Alton, Jacksonville & Peoria Railway Company is contemplating the construction of 17 miles of track during 1910, extending from Godfrey to Jerseyville, Ill. W. R. Heager is general manager.

JOLIET, ILL.—Plans for the installation of the boulevard system, to be installed in the business district of Joliet by the Economy Light & Power Company, are nearly completed, and work will commence on the system in the near future. The wires will be placed in underground conduits. Charles A. Munroe is general manager of the company.

OAK PARK, ILL.—Plans are being prepared for an addition to the power plant of the Oak Park Light, Heat & Power Company. A. E. Roberts, of Oak Park, is the architect.

PEKIN, ILL.—The Commissioners of the La March Drainage District are contemplating the installation of a motor-driven centrifugal pump, electricity for which will be supplied by the local electric plant. The headquarters of the Commission are located in Pekin.

PEKIN, ILL.—The stockholders of the Pekin Mutual Telephone Company have voted to increase the capital stock of the company from $20,000 to $40,000. The company has recently absorbed the Tazewell County Telephone Company, of Morton, and the Union Independent Company, of Tremont.

POLO, ILL.—Negotiations have been closed whereby the Oregon Power Company has secured the controlling interest of the Polo Electric Light & Power Company, taking possession of the same immediately. The new company will continue the service as before, giving an all-night service in addition. As soon as its plant in Oregon is completed the service in Polo will be furnished direct from the Oregon plant, and a 24-hour service established.

TAMPICO, ILL.—The Dixon, Rock Falls & Southwestern Electric Railway Company contemplates the construction of an electric railway extending from Tampico to Geneseo, via Rock Falls and Hooppole, a distance of 30 miles. Orders for rails have already been placed.

BRAZIL, IND.—The Board of County Commissioners has granted a franchise to the Electric Transmission Company, of Cincinnati, Ohio, to erect transmission lines in the Township of Lewis. The company at present operates an electric light plant at Jasonville, and proposes to extend its electric service to Coalmount, seven miles distant, and to farmers along the route. It is said the company proposes to extend its system to all parts of the county within the next two years.

DELPHI, IND.—The City Council has granted the Fort Wayne & Wabash Valley Traction Company, Fort Wayne, Ind., a franchise to furnish electricity for lamps, heat and motors in Delphi. The Carroll Electric Company is operating an electric plant in Delphi at present, but does not furnish a day service.

EVANSVILLE, IND.—The City Council has granted the Evansville Public Service Company a 25-year franchise to furnish electricity for lamps and motors and heat from a central station in Evansville. Under the franchise the maximum rate for electricity is 7½ cents per kw-hour, which is 2½ cents lower than the present rate. The company is capitalized at $250,000. A. L. Bernardin, David Ingle, George M. Snyder and others are interested in the company.

FORT WAYNE, IND.—Bids will be received by the Board of Public Works until Dec. 20 for furnishing and installing a steam boiler of from 350 to 500 hp, with automatic stoker and single-cylinder stoker engine, in the municipal electric light plant. Plans and specifications are on file at the office of the Board of Public Works.

INDIANAPOLIS, IND.—Bids will be received by the Board of Public Works until Dec. 20 for furnishing and installing all electric or gas lighting fixtures in the new city hall.

MONTICELLO, IND.—The Indiana Northwestern Traction Company has purchased the Chicago Heights & Eastern Electric Railroad, which will give it terminal facilities in Chicago, Ill. Arrangements have been made for an immediate survey of the route. The contract for construction of the railway has been awarded to the La Salle Supply & Construction Company, of Monticello, Ind.

NOBLESVILLE, IND.—A number of industrial manufacturing companies are making applications for locations and power in the city. The White River Light & Power Company, which is constructing a hydroelectric plant on the White River, will furnish the power service. The company is taking contracts at the rate of 5 cents per kw-hour. It is expected to have the plant ready for operation by Jan. 15.

SEYMOUR, IND.—The city controller has been enjoined temporarily from entering into a contract with the Indiana Public Utilities Company for street lighting. The City Council recently granted the utilities company a franchise to construct and operate a new plant. The injunction was secured by the Merchants' Electric Light Association, with which the new company would become a competitor. The Indiana Public Utilities Company proposes to go ahead with the construction of a new plant.

WEST POINT, IND.—The West Point Co-Operative Telephone Company has incorporated to construct and operate telephone lines and exchanges in Tippecanoe, Fountain and other adjacent counties. The principal office and exchange will be in West Point. Lewis J. Clement, John C. Whitehead, Benjamin Turner, J. F. Martin, S. R. Stover and G. R. Tubbs are incorporators.

DAVENPORT, IA.—We are informed that the Mississippi Shore Line Railway proposes to construct an interurban railway extending from Davenport to Muscatine. For further information address Walter D. Olney, Lock Box 430, Davenport, Ia.

KEOKUK, IA.—H. L. Cooper, 60 Wall Street, New York, N. Y., and associates are reported to be planning to commence work soon on the construction of a large dam in the Mississippi River in connection with a hydroelectric power project. The Keokuk & Hamilton Water Power Company is behind the project.

MARSHALLTOWN, IA.—F. G. Pierce, former mayor of the city and secretary of the Iowa League of Municipalities, is circulating a petition asking for a special election to vote on municipal ownership of the electric, gas and street railway systems, owned and operated by the Marshalltown Light, Power & Railway Company.

MARSHALLTOWN, IA.—At the special election held Nov. 29 the proposition to grant three public service franchises to run for a term of 25 years to Darling & Schroeder, of Chicago, Ill., was defeated. The franchises were for electric, gas and street railway systems, and were defeated because it was believed that the applicants were representing the present owners of the existing franchises for these utilities, which expire in eight years.

WATERLOO, IA.—It is reported that the William Gallaway Company, of Waterloo, Ia., is in the market for an engine and generator.

LEAVENWORTH, KAN.—Preparations are being made by the Leavenworth Light, Heat & Power Company for extensive improvements to its plant, which will involve an expenditure of about $25,000. The output will be increased from 1400 to 2400 hp. The work will include the erection of an addition to the boiler house, the installation of new boilers and two turbo-generator sets with a rating of 500 hp each. E. S. Springer is superintendent.

SABETHA, KAN.—At an election held recently the citizens voted to issue $65,000 in bonds, the proceeds to be used for the construction of an electric light plant and water-works system.

SALINA, KAN.—It is reported that the People's Light, Heat & Power Company is contemplating doubling the output of its generating plant.

WICHITA, KAN.—The City Commissioners have passed an ordinance compelling the Wichita Railroad & Light Company to build the Mt. Carmel extension within six months, making the penalty an absolute forfeiture of the franchise on that street.

WICHITA, KAN.—Plans are being considered by the Wichita Railway & Light Company for increasing the output of its power plant to 1500 kw, and building 10 miles of new track during 1910. W. A. Martin is purchasing agent.

WICHITA, KAN.—The American Power & Light Company, of New York, N. Y., which has taken over the properties of the Edison Light & Power Company, the United Gas Company and the Gas & Appliance Company, in Wichita, Kan., it is said, contemplates enlarging the present power house of the Edison Light & Power Company or constructing a new one.

CARLISLE, KY.—The East Telephone Company and L. C. Griffiths, of Louisville, Ky., each have purchased a franchise to construct and operate a telephone system in Carlisle. The franchises were offered to the highest bidder and sold at $100 each. The East Tennessee Telephone Company has been operating a telephone system for some time without a franchise.

LOUISVILLE, KY.—The Central Home Telephone Company, owning several lines and exchanges in Kentucky and Southern Indiana, was sold Dec. 1 to E. H. Cady, representing bondholders of Toledo, Ohio, for $250,000.

BANGOR, MAINE.—Negotiations have been closed whereby the Bangor Railway & Light Company has secured the entire property known as the Veazie Mills water power and dam. The company held one-quarter interest in property. It is understood that the company contemplates the construction of a new concrete dam.

PORTLAND, MAINE.—Plans and specifications for electric work and plumbing for the new city hall building, Portland, Maine, have been revised, and bids will be received by the City Hall Building Commission at the Mayor's office until Jan. 3, 1910. Plans and specifications can be seen at the offices of Architects Carrere & Hastings, 225 Fifth Avenue, New York, N. Y., and John Calvin Stevens and John Howard Stevens, Portland, Maine.

ROCKLAND, MAINE.—Plans are being considered by the Rockland, South Thomaston & Owl's Head Railway Company for the construction of a railway connecting Martin with South Thomaston, a distance of three miles. John T. Berry is superintendent.

POCOMOKE, MD.—The Electric & Ice Manufacturing Company has taken over the plant and holdings of the Stevenson Electric Light Company, of Pocomoke, Md. The new company is building a new power house and contemplates the installation of a 10-ton ice plant. Newton & Painter are consulting engineers. Riley M. Stevenson, of Pocomoke, Md., is president and manager.

EASTHAMPTON, MASS.—The cable connecting the Easthampton Gas Company's plant with the Connecticut River Power Company's system will be laid next spring. After the connection is made the present steam plant of the Easthampton Gas Company will be held for emergency purposes. When the new system is installed the company will be able to furnish electricity for motors, as well as lamps. It is expected when the new system is in operation that electricity will be used in several of the mills.

ESSEX, MASS.—At a special town meeting held recently the citizens voted to accept the proposition submitted by the Gloucester Electric Company to light the streets of the town. The company will furnish 100 incandescent lamps of 32 cp each for $1600 and will supply electricity for lighting the town hall to the amount of $50. For the next 25 lamps added the cost will be reduced to $15.50 per lamp, and for all over that amount the price will be $15 per lamp per year. E. L. Munger is manager of the Gloucester Electric Company.

LAWRENCE, MASS.—The Ayer Mills of the American Woolen Company, at Lawrence, Mass., now under construction, will be equipped for electric motor drive. The initial installation of the power house will include two units, with a rating of 2500 kw each.

MARBLEHEAD, MASS.—Work has commenced on the improvements to the municipal electric light plant, for which an appropriation of $30,000 was recently made. Two 100-kw turbine engines are being installed to replace four arc machines now in use. The present street lighting system will be replaced with new flaming arc lamps.

PITTSFIELD, MASS.—The Pittsfield Electric Company has engaged Stone & Webster, of Boston, Mass., to prepare plans for enlarging its plant at Silver Lake to increase the output to 1000 hp. As soon as the plans are completed, the company will petition the State Commissioners of Gas and Electricity for permission to increase its capital stock.

READING, MASS.—The town has voted to appropriate $1,800 to extend the electric service from the municipal electric plant to the filtration plant now being installed in connection with the water works system.

SPRINGFIELD, MASS.—The Council committee on lighting streets states that no immediate action will be taken on the permission granted by the Council to erect a large electric sign on the South End Bridge, as it has decided that the improvement in lighting Main Street is more important. About 25 additional arc lamps will be erected on Main Street, between Carew and Locust Streets.

TAUNTON, MASS.—The Globe-Taunton Nail Company is reported to be contemplating the construction of a new plant to replace the buildings destroyed by fire in September. The power plant equipment will include a 350-hp engine, 350-kw generator, 12 electric motors, etc. The company is now occupying temporary quarters.

THREE RIVERS, MASS.—Plans are being prepared for the construction of a new hydroelectric power plant for the Palmer mills of the Otis Company, at Three Rivers, Mass. The work will probably involve the erection of a new dam at the foot of the gorge below the mill and the abandonment of the present dam and canal.

WORCESTER, MASS.—A deal has been closed between the Worcester Electric Light Company and the Connecticut River Transmission Company, whereby the transmission company will acquire the right to use the poles, lines and conduits of the Worcester Electric Light Company throughout the city for the transmission of electricity. Under the terms of its franchise the transmission company cannot furnish electrical service to consumers using less than 300 hp. It is expected that the company will furnish energy in Worcester within a short time, as its substation at Glendale is practically completed and the transmission line has been extended nearly to the point where it will connect with the lines of the Worcester company. The company will furnish electricity to the south works of the American Steel & Wire Company to operate its large electric furnace, which will soon be started.

NILES, MICH.—The Michigan State Telephone Company is contemplating making extensive improvements to its system in Niles, which will involve an expenditure of about $30,000. The improvements will include the construction of a new telephone exchange and the installation of a new switchboard capable of handling 1,500 telephones.

STURGIS, MICH.—It is reported that bids will soon be called for machinery for a new municipal power plant, plans for which are now being prepared.

STILLWATER, MINN.—The State Board of Control has awarded the Washington County Light & Power Company a contract to furnish electricity for lamps and motors for the new state prison and its factories. The prison was formerly lighted by the steam plant located in the prison. The service will be supplied from the hydroelectric plant at Riverside on Apple River in Wisconsin. Work on construction of the transmission line will commence at once. This line will also enable the company to supply electrical service in Oak Park.

CHARLESTON, MISS.—Improvements are contemplated to the municipal electric light plant, water works and sewerage system, which will involve an expenditure of about $10,000.

MERIDIAN, MISS.—Application has been made to the City Council by M. R. Grant and associates for a franchise to construct and operate an electric light plant and street railway in Meridian.

SEMINARY, MISS.—The Home Telephone Cimpany, of Meridian and Jackson, has closed a deal with the local company to establish a telephone system throughout the county, to be known as the Covington County Telephone Company.

KANSAS CITY, MO.—It is reported that the Indiana Silo Manufacturing Company, of Anderson, Ind., is contemplating the construction of a large plant in Kansas City, Mo., which will be operated entirely by electricity. Power for operating the plant may be purchased.

KANSAS CITY, MO.—It is officially announced that the Kansas City, Lawrence & Topeka Electric Railroad Company expects to construct an electric railway from Monrovia to Lawrence, Kan., passing through De Soto and Hannibal, a distance of 32 miles. Willard W. Winner is purchasing agent.

LEES SUMMIT, MO.—Application has been made to the Council by Levi G. Morris and others for a franchise to construct and operate an electric light and power plant in Lees Summit.

MEXICO, MO.—We are informed that the Mexico, Santa Fe & Perry Traction Company expects to place contracts for material and apparatus for the construction of about 100 miles of track. All material will be purchased through Burns & Company, Isabelle Building, Chicago, Ill. The proposed railway will extend from Mexico to Columbia and Fulton, thence to Santa Fe, Parry and Hannibal. It is said that the company will soon award contracts for the construction of three power plants. C. W. Gaither is secretary.

ST. LOUIS, MO.—The Majestic Range Company, St. Louis, Mo., is contemplating the erection of an addition to its plant. The company is considering the installation of electric motor-driven machinery.

ST. LOUIS, MO.—Preparations are being made by the St. Louis, Lakewood & Grant Park Railway Company for the construction of a six-mile extension to the Meramac River during the coming year. E. G. Hughes is general manager.

ST. LOUIS, MO.—The North Missouri Central Railway Company has awarded a contract to the M. A. Talbott Company, of Baltimore, Md., for the construction of its interurban railway to extend from Jefferson City to Mexico, via Columbia, 60 miles in length. Headquarters of the company are in the National Bank of Commerce Building. St. Louis, Mo. O. F. Spaete is president.

ST. LOUIS, MO.—Preparations are being made to change the motive power of the Chicago, Peoria & St. Louis Railway from steam to electricity. The road, which is known as the "Bluff Line," is at present in the hands of a receiver, but it is understood that it will be taken over by a syndicate of Illinois capitalists and converted into an electric line. The railway is about 200 miles in length. J. P. Ramsey, president of the company, who is also receiver, is one of the incorporators of the new syndicate. Howard Beehler, J. J. Frazer, L. G. Lockbridge, B. F. Burns and others are interested in the enterprise.

SLATER, MO.—The City of Slater is contemplating the installation of a 250-hp gas producer plant or a steam-driven plant with electric generator and motor-driven deep well pump. The city would like to communicate with manufacturers and dealers in above apparatus. For further information address L. E. Shepherd, superintendent Slater Light and Water Works.

WHITEHALL, MONT.—Plans are being prepared by the Montana Independent Telephone Company for the construction of a telephone line to Dillon by the way of Twin Bridges and the Beaver head valley

and the erection of a branch line up the valley to Sheridan, Ruby and Virginia City.

HARVARD, NEB.—Preparations are being made by O. J. Shaw, of Aurora, Neb., who recently secured a franchise, to erect an electric light plant in Harvard. It is expected to have the plant completed by March 1.

HASTINGS, NEB.—A company is being formed by residents of this city for the purpose of installing an electric light plant.

VALENTINE, NEB.—The contract for the construction of the municipal electric light plant and water-works system was awarded to the Katz-Craig Contracting Company, Omaha, Neb.

RHYOLITE, NEV.—The Buckeye Mill & Mining Company, of Fish Springs, contemplates the installation of an electric plant on Birch Creek to furnish electricity to operate its mill, now being erected. Leonard Davis is general manager.

MANCHESTER, N. H.—The Water Commissioners are considering the question of installing an electric pump at the low-pressure station.

FLEMINGTON, N. J.—Preparations are being made by the Flemington Electric Light, Heat & Power Company for the installation of a new lighting system. An all-night schedule will be established and 35 Westinghouse arc lamps of 2000 cp will be placed in the principal sections of the town. A large number of tungsten lamps will be installed. The new contract covers a period of five years.

POINT PLEASANT, N. J.—We are informed that the Point Pleasant Traction Company expects to place orders in the near future for two 150-hp water tube boilers. F. B. Musser, of Harrisburg, Pa., is purchasing agent.

ARTESIA, N. MEX.—Plans are being considered to erect a hydro-electric power plant on the Penasco River, to furnish electricity to operate pumps for irrigating a large portion of the Pecos River Valley in New Mexico. It is estimated that about 15,000 hp can be developed and the cost of pumping the water would be about $2 per acre. L. K. McGaffey and J. F. Hinkle, of Roswell, N. Mex., are interested in the project.

ROSWELL, N. MEX.—The Roswell Electric Light & Power Company has notified the farmers of the Roswell section that it is prepared to furnish electricity for the irrigation of 10,000 acres of land during the coming season, and that it will extend its transmission lines for a distance of 25 miles if the use of electrical energy for irrigating 5,000 acres is guaranteed.

ROSWELL, N. MEX.—The Roswell Telephone Company has placed a contract with J. A. Russell, representative of the Western Electric Company, for new equipment for its new building, including switchboard, power plant, new telephones, etc.

BROOKLYN, N. Y.—Preparations are being made by the Brooklyn Rapid Transit Company for the construction of a new electric railway through Utica Avenue and Avenue N to Jamaica, work on which will commence soon. The new line will be about four miles in length and will serve as an extension to the Reid Avenue line.

DUNKIRK, N. Y.—The Niagara & Erie Power Company has petitioned the Common Council for a franchise to extend its transmission line to the Brooks Locomotive Works in Dunkirk.

DUNKIRK, N. Y.—Application has been made to the City Council by the Dunkirk Power & Heating Company for a franchise to build conduits for the transmission of electricity in Dunkirk.

JAMESTOWN, N. Y.—Announcement has been made that the property of the Jamestown Lighting & Power Company has been purchased by A. N. Broadhead and associates, who control the Chautauqua Traction Company. The price paid for the plant was $90,000, which was the sum for which the plant was offered to the Board of Lighting Commissioners of Jamestown, to be incorporated with the municipal electric plant, but which the taxpayers refused to pay by a small majority.

LONG ISLAND CITY, N. Y.—The Long Island Railroad Company contemplates building 28 miles of new track during 1910.

LYONS, N. Y.—The plant and holdings of the Wayne County Electric Company have been purchased by William T. Morris and associates, of Penn Yan. The company furnishes electrical service in Lyons and Clyde.

NEW YORK, N. Y.—Plans have been filed by the Metropolitan Street Railway Company for a one-story substation to be erected on Madison Avenue, south of Eighty-sixth Street, at a cost of $3,500, which later will give place to a larger building.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, corner of Park Avenue and Fifty-ninth Street, New York, N. Y., until Dec. 20 for repairs, alterations and additions to the electric equipment in Public School 11, 314 West Seventeenth Street, Borough of Manhattan. Bids will also be received at the same time and place for alterations to electric equipment in hall of Board of Education, corner of Park Avenue and Fifty-ninth Street, Borough of Manhattan, New York.

NORTH SYRACUSE, N. Y.—Plans are being considered for lighting the streets of the village of North Syracuse. It has not yet been decided whether gas or electricity will be used.

OSWEGO, N. Y.—The City Council has granted the Syracuse, Lake Shore & Northern Railroad Company a franchise to enter Oswego as a terminus for its proposed Fulton extension.

ROCHESTER, N. Y.—It is reported that the A. J. Bottom Company, of Rochester, N. Y., is planning to install two engines and generators, having a total rating of 300 hp.

ASHEVILLE, N. C.—The Asheville & East Tennessee Railroad Company expects to construct during the coming year seven miles of track extending from Weaverville to Grantville, Ohio.

CONCORD, N. C.—The buildings of the Locke Cotton Mills Company have been completed and machinery is being installed. The equipment will include 35,000 spindles, 1000 looms, etc. Both steam and electrical power will be used, and from 1300 to 1400 hp will be required. J. Locke is president and treasurer.

DURHAM, N. C.—The new No. 4 mill of the Erwin Cotton Mills Company is ready for occupancy. The equipment will include 50,000 spindles and 1500 looms. The mill will be operated by electricity and will require 3000 hp, which will be generated at the company's own plant. The power equipment includes a 2500-hp steam turbine.

KENMARE, N. D.—The Northern Telephone Company is contemplating the installation of extensive improvements to its system.

WASHBURN, N. D.—The Independent Telephone Company contemplates the construction of a telephone line to Stanton.

DEFIANCE, OHIO.—The People's Gas & Electric Company proposes to add three miles of new track to its system during 1910.

ELYRIA, OHIO.—Improvements are being made to the equipment of the plant of the Elyria Iron & Steel Company, which will include the purchase of additional electrical apparatus.

MAUMEE, OHIO.—It is reported that the Phoenix Light & Power Company will require oil-filled, self-cooled static transformers of from 300 to 500 kw.

PERRYSBURG, OHIO.—The capital stock of the Suburban Light & Power Company has been increased from $15,000 to $50,000.

TOLEDO, OHIO.—Announcement has been made that the Toledo, Urban & Interurban Railway Company will, during the coming year, extend its railway from Findlay to Kenton, Ohio, a distance of 32 miles. C. F. Smith is purchasing agent.

TOLEDO, OHIO.—The Citizens Lighting & Heating Company has purchased the stock of the Maumee Valley Electric Company, which owns the old power plant used by the Maumee Valley belt line at Miami, and also the water rights granted by the State at the new dam at Grand Rapids. Work has commenced on improving the plant and enlarging the forebay and headgates as well as the penstocks; also for foundations for wheels and wheel pits. The old machinery will be discarded and new equipment installed. The plant when completed will have an output of 3000 hp. The company paid $60,000 for the property and will expend about $100,000 for improvements to the plant. James M. Ashley, local representative of the Citizens Heating & Lighting Company, who has already applied to the City Council for an extension of the franchise of the company, it is said, expects to petition for another extension, in January to cover the whole city. The company now has a franchise covering 28 blocks in the down-town section of the city; the present extension contemplates an addition of 25 blocks. When the company secures its complete franchise it is planned to make it the distributing company for the corporation that has purchased the water rights on the canal and river. It is said that the parties behind the company propose to generate 10,000 hp—3000 from the Miami plant, 3000 from the Grand Rapids dam and 4000 from two other water rights for which they are negotiating. The plans complete contemplate an expenditure of about $1,250,000.

APACHE, OKLA.—The citizens have voted to issue $8,000 in bonds for the construction of an electric light plant, plans for which are being prepared by the Southwestern Engineering Company, of Oklahoma City, Okla. H. Peeper is Mayor.

ENID, OKLA.—Contracts will be awarded by the Enid & Central Oklahoma Traction Company for the construction of its interurban railway between El Reno and Enid, 65 miles in length. W. S. Whittinghill is president.

SULPHUR, OKLA.—The plant of the Sulphur Light & Power Company, which was recently purchased by W. A. Swanson Electric Company, of Larned, Kan., is being entirely rebuilt.

ASTORIA, ORE.—Arrangements are being made by the Pacific States Telephone Company for the construction of long-distance telephone lines from Astoria to Seaside and also from this city to Hammond, Fort Stevens and Ilwaco.

FOREST GROVE, ORE.—A. Welch, of Portland, Ore., has submitted a new ordinance to the City Council relative to furnishing electricity in Forest Grove. Under the new ordinance the applicant will be given a 25-year franchise and will secure control of the present equipment owned by the city and also furnish 25 arc lamps for street lighting for a term of 25 years. The company will maintain a pump and furnish electricity to operate the same in case of emergency, at the rate of two cents per kw-hour.

PORTLAND, ORE.—The Oregon Electric Railway Company is planning to construct about 50 miles of new track during 1910, one branch extending from Tigard to McMinnville, Ore.; the other connecting Salem and Albany, a distance of 25 miles. George F. Nevins is purchasing agent.

SALEM, ORE.—Application has been made to the State Engineer by W. R. Winans for permission to appropriate water rights of the Hood

River, to be utilized for power purposes. Mr. Winans is interested in a project to construct an electric railway for the Hood River Valley, which will be a belt line and tap the apple districts of the valley. It is estimated that 20,000 hp can be developed at a point a few miles below the forks of the river.

CHARLEROI, PA.—The West Side Electric Street Railway Company is planning to construct an interurban railway extending from Charleroi to Ellsworth, a distance of 10 miles, next year. D. G. Callihan, of Belle Vernon, Pa., is general superintendent.

MILLVALE, PA.—Bids will be received at the office of H. H. Dixon, borough clerk, until Dec. 23 for furnishing machinery and constructing an addition to the municipal electric light and water plant, as follows: Steel or brick addition on concrete foundation; steam boilers and stack; steam engine, feed-water heater, piping; alternator, rectifiers, arc lamps, exciter, switchboard and appurtenances. Plans and specifications can be seen at the office of the borough clerk. William Fox is president of Council.

NORRISTOWN, PA.—Bids will be received until Dec. 29 by John L. West, steward of the State Hospital for the Insane of the southeastern district of Pennsylvania, for one air compressor, engine, dynamo, motor generator and switchboard.

OAKMONT, PA.—Preparations are being made for the construction of an electric railway extending from Oakmont to Kittanning. The road will be known as the Pittsburg & Allegheny Valley Street Railway.

PHILADELPHIA, PA.—The contract for furnishing and installing an arc lighting system for the electric towers in the college was awarded to J. F. Buchanan & Company for $4,087. William A. Anderson secured the contract for improvements to the power house, including a Westinghouse steam-driven air compressor and tank and making connection between the underground duct and filter house, for $4,620.

PITTSBURGH, PA.—The Pittsburgh, Chester & East Liverpool Street Railway Company expects to commence work on its proposed railway early in the spring. The railway will extend from Pittsburgh to East Liverpool, a distance of 35 miles. The motive power has not yet been definitely decided upon.

PHOENIXVILLE, PA.—The Phoenixville, Valley Forge & Stafford Electric Railway Company, recently organized, proposes to construct an electric railway, 10 miles in length, extending from Phoenixville to Stafford, which is the terminus of the Philadelphia & Western Railroad Company's third-rail system. The power plant and repair shops will be located at Valley Forge. The company will furnish electricity for lamps to towns along the route of its railway. Thomas E. O'Connell, of West Chester, Pa., is president and general manager.

WELLSBORO, PA.—The Tioga Traction Company, which proposes to construct an electric railway 15 miles long to connect Wellsboro, Whitneyville, Cherry Flats, Covington and Mansfield, has secured the necessary rights of way and expects to commence work early in the spring. The company proposes to locate its power plant and repair shops in Wellsboro. It will also furnish electricity for lamps to towns along its route. B. F. Edwards, of Wellsboro, is president, and George F. Keagle, of Avis, general manager and purchasing agent.

CHARLESTON, S. C.—The Charleston Consolidated Railway Gas & Electric Company expects to place contracts within the next few weeks for a 1000-kw turbine. P. H. Gadsden is president.

CHARLESTON, S. C.—A company has been incorporated by D. G. Zeigler, of Jacksonville, Fla.; G. H. Miller, S. J. Platsch, and others, for the purpose of constructing a hydroelectric power plant on the Edisto River, 28 miles from Charleston. The company is capitalized at $1,500,000 and proposes to develop 12,000 hp for electric transmission.

CHESTER, S. C.—It is reported that the construction of an electric railway from Chester to Great Falls, via Richburg and Lando, is under consideration. The principal power plant of the Southern Power Company is located at Great Falls, S. C.

BELLVILLE, TEX.—The amount necessary has been subscribed for the construction of an ice, light plant and creamery in Bellville. The Bellville Promoting Company has been formed by C. F. Hellmuth, C. Schauerhammer and others to operate the plant.

GALVESTON, TEX.—The City Council has adopted the report of the committee recommending the acceptance of the bid of the Lowe Electric Company, of Galveston, Tex., for the installation of turbo-generators rated at 2100 kw, together with condensers, at $11,900. The company is to allow the city $900 for the old engines, etc., in the power plant.

GREENVILLE, TEX.—The city is building a new municipal electric light plant. The cost of the entire plant is estimated at $80,000.

HASKELL, TEX.—The Haskell Power Company will install electric generating machinery and auxiliary apparatus in its plant this winter.

LEWISVILLE, TEX.—The Lewisville Light & Power Company is reported to be considering the construction of a new power house during the coming year.

WINCHESTER, TENN.—Bonds have been sold by the city to the amount of $14,000, the proceeds to be used for improvements to the municipal electric plant and water works. The power house will be remodeled and new water wheels installed.

PARK CITY, UTAH.—The City Council has granted the Park City Light, Heat & Power Company a 25-year franchise for lighting the city. Under the new franchise the rates for electricity for lamps will be reduced from 15 cents to 11 cents per kw-hour. The minimum charge is reduced from $1.50 to $1 per month. The price for street lamps is $1 per month and the company is to furnish electricity for lighting the city building free of charge.

SALT LAKE CITY, UTAH.—Steps have been taken by which it is hoped to accomplish a reorganization of the Salt Lake Public Service Company, of Salt Lake City, which was organized several years ago by parties from Columbus, Ohio. The receiver of the company has succeeded in getting an extension until 1910 of the water rights of the company, which will give ample time to complete construction of the plant and save the water rights, which are the most valuable assets of the company.

NORTHFIELD, VT.—Messrs. Moody & Allen, of Montpelier, Vt., who have the contract for street lighting in Northfield, are making preparations for the construction of another power plant above their present plant in Middlesex, where they own the water privilege and necessary land for flowage. The cost of the plant is estimated at about $55,000.

STOWE, VT.—The contract for the construction of the high-tension transmission line from Cady's Falls to Stowe has been awarded to the Northern Electric Company, of Burlington, Vt. The transmission line will furnish electricity from the Morrisville municipal electric plant to operate the Mt. Mansfield Electric Railroad, which extends from Waterbury to Stowe. M. C. Clark is general manager of the Northern Electric Company.

MARTINSVILLE, VA.—The Martinsville Cotton Mills Company has increased its capital stock to $600,000 and may install a larger plant than at first proposed. The buildings are ready and part of the machinery is in place. The equipment will include 18,000 spindles, 466 looms, etc., for the manufacture of fine sheeting. The plant will be operated by electricity, which will be supplied by the municipal electric light plant. The company has contracted with the city for 500 hp. Z. T. McKinney is president of the company.

RICHMOND, VA.—The Virginia Railway & Light Company contemplates the installation of an additional steam turbine electric generating unit in its power plant for emergency purposes.

RICHMOND, VA.—The City Council has appropriated an additional $65,000 for the municipal electric light plant, to be used for the construction of the distributing system. The total appropriation to date has been $415,000.

CHELAN, WASH.—The Chelan Electric Company, a subsidiary of the Great Northern Railroad Company, is contemplating the construction of a large dam across the Chelan River gorge at a point near Cape Horn, between Chelan and Chelan Falls on the Columbia River. It is estimated that about 80,000 hp can be developed at a cost of about $5,000,000. Electricity generated at the plant will be utilized to operate the electric lines of the Great Northern, and will also be furnished to cities for lighting and to pump water for irrigation from Lake Chelan and the Columbia. The exact location of the dam has not yet been decided upon.

RIVERSIDE, WASH.—The Okanogan County Telephone Company and the Johnson Creek Telephone Company have been consolidated under the name of the Okanogan County Telephone Company. It is said that extensive improvements will be made to the systems.

SEATTLE, WASH.—Contracts have been awarded by the Board of Public Works for the installation of a cluster lamp system on Eighteenth Avenue as follows: For conduits, etc., to C. F. McDonald for $15,020, for cast-iron poles and insulators to the Olympic Foundry Company for $2,902.

TACOMA, WASH.—The City Council has authorized the Commissioner of Public Works to advertise for bids for the construction of the dam, headworks and tunnel for the power canal in connection with the proposed municipal electric plant as soon as plans are prepared. It is expected that work on the plant will commence about Feb. 1, 1910. The work now to be undertaken will involve an expenditure of about $650,000; the entire plant will cost about $2,000,000. Frank C. Kelsey is engineer.

WALLA WALLA, WASH.—Announcement has been made by the Washington-Oregon Traction Company that owing to the failure to secure a franchise in Walla Walla the company will move to Pendleton, Ore., and from there will start work on its proposed traction system, which will involve an expenditure of $3,000,000.

WILKESON, WASH.—W. A. Corder Company, of Wilkeson, Wash., is reported to be in the market for a 100-kw generator.

MORGANTOWN, W. VA.—The Union Utilities Company will soon be in the market for a 200-kw, 60-cycle generator and a low pressure turbine. H. R. Warfield is general manager.

KILBOURN, WIS.—Owing to the engine in the municipal electric light plant having been wrecked beyond repair it has been decided to secure electricity from the hydroelectric plant of the Southern Wisconsin Power Company's plant in Kilbourn to operate the municipal electric light system.

LA CROSSE, WIS.—The La Crosse Street Railway Company has received permission for the State Commission to issue $50,000 in bonds, the proceeds of which to be used for the purchase of new cars, power house equipment and for improvements and extensions to its track system.

MILWAUKEE, WIS.—Permission has been granted to the Milwaukee Western Electric Railway Company to construct an electric railway to Beaver Dam, Wis., a distance of 56 miles, with a branch from Sussex through Pewaukee to Waukesha. It is said that the power house will be located in Hustisford.

NEW LONDON, WIS.—Preparations are being made by the Wisconsin Telephone Company for rebuilding its telephone lines and remodeling its exchange in New London, Wis., which will involve an expenditure of about $14,000.

STEVENS POINT, WIS.—Plans have been prepared by the Vetter Manufacturing Company for changing its present power system to electric motor drive.

TOMAH, WIS.—A new steam turbine power plant rated at 1200 hp is being installed by C. A. Goodyear Company to furnish electricity to operate its planing mill as well as the main factory. Alternating-current motors will be used for driving the planing mill.

RED DEER, ALT., CAN.—Negotiations are under way between the town officials and the Western General Electric Company with a view of purchasing the electric plant of the company.

PRINCE RUPERT, B. C., CAN.—The telephone committee of the Prince Rubert Board of Trade has secured stock subscriptions to the extent of $10,000, the amount necessary for the organization of a local company.

PRINCE RUPERT, B. C., CAN.—It is reported that a syndicate backed by London and New York capital is contemplating an expenditure of about $5,000,000 in Prince Rupert, which will include the installation of an electric lighting and street railway systems, and the erection of a smelter for the treatment of ores of the mining districts of the north and other industries. The project includes a steamship service to points between Prince Rupert and Portland Canal.

VANCOUVER, B. C., CAN.—The British Columbia Electric Railway Company has appropriated $6,000,000 for improvements to its system. It is said that work will commence immediately on the construction of a 20,000-hp auxiliary plant in Vancouver.

VICTORIA, B. C., CAN.—The British Columbia Telephone Company is contemplating extensive improvements to its system, including the laying of an additional cable across the gulf.

SELKIRK, MAN., CAN.—The Town of Selkirk is contemplating taking over the electric light plant now owned by the Selkirk Electric Light & Power Company, to be operated as a municipal plant. W. E. Skinner, of Winnipeg, has been engaged to place a valuation on the plant.

ESSEX, ONT., CAN.—The local electric light plant was completely destroyed by fire on Dec. 6.

FORT FRANCES, ONT., CAN.—Contracts have been awarded by the Corporation of Fort Frances for equipment for the municipal electric light system, as follows: Arc lamps to the Canadian Westinghouse Company; meters to the Canadian General Electric Company, and transformers to the Allis-Chalmers, Bullock Company. Power for operating the system will be secured from the International Falls Power Company, which is installing an electric plant equipped with four 1250-kw units. W. E. Skinner, of Winnipeg, Man., is consulting engineer for the Town of Fort Frances.

HAMILTON, ONT., CAN.—A recommendation has been submitted to the Council to install 52 arc lamps in the new annex district. It will cost about $2,300 a year to maintain the lamps.

HAMILTON, ONT., CAN.—The Board of Works has authorized City Engineer Macallum to confer with the Hydro-Electric Power Commission in connection with the erection of a transmission line from Dundas through the city to the Beach pumping station.

HAMILTON, ONT., CAN.—Extensions are contemplated by the Hamilton, Waterloo & Guelph Railway Company during 1910, which will require the construction of about 60 miles of new track. One line will extend from Hamilton to Berlin and the other from Hamilton to Guelph. John Patterson is general manager.

LONDON, ONT.—The Southwestern Traction Company contemplates the construction of extensions to its system of from 20 to 40 miles, one of which will extend from London to Ingersoll, and the other from St. Thomas to Aylmer, Ont. S. W. Mower is general manager.

OTTAWA, ONT., CAN.—At a meeting of the Board of Control a by-law was approved granting a franchise to the Metropolitan Electric Company, Ltd., upon the stipulation that the company must be in a position to deliver 1000 hp in Ottawa within three years from the date of passing the by-law. It is expected that the by-law will be submitted to the citizens at the January municipal elections.

OTTAWA, ONT., CAN.—Application has been made to the Dominion Parliament for incorporation of the Ottawa, Rideau Valley & Brockville Railway Company, with power to construct and operate a railway by electricity or other motive power from the city of Ottawa to the town of Brockville; also to operate a ferry service across the St. Lawrence River from Brockville to Morristown, N. Y., and to build an extension of the main line from Ottawa to High Falls, in the Province of Quebec. Permission is also asked to develop water power, to be utilized to generate electricity for lamps, heat and motors. D. H. McLean, of Ottawa, is solicitor for the applicants.

QUEBEC, QUE., CAN.—The Quebec Light, Heat & Power Company, of Quebec, recently organized, has purchased the holdings of the American Light & Traction Company in the Quebec-Jacques Cartier Electric Company, which completes the monopoly by the new company of the public service utilities in Quebec and adjacent territory. Instructions have been given to Edward A. Evans, chief engineer of the Quebec Railway, Light & Power Company, to prepare and revise plans already made in connection with the construction of the Quebec & Saguenay Railway from St. Joachim to Murray Bay.

GUANAJUATO, MEX.—The Guanajuato Electric & Power Company has increased its capital stock from $6,000,000 to $12,000,000, the proceeds to be used for the construction of new plants and extension of transmission lines. The company proposes to construct a new generating plant at Peruondero and another at Penjamo.

LLUVIA DE ORO, CHIHUAHUA, MEX.—The Lluvia de Oro Gold Mining Company is making extensive improvements to its power plant and has placed orders with the Allis-Chalmers Company, of Milwaukee, Wis., for equipment as follows: For one hydraulic turbine direct connected to a 400-kw, 60-cycle, three-phase, 6600-volt generator, a 25-kw, 120-volt exciter, belted to generator and a two-panel switchboard with necessary instruments, etc.

SAN BERNANDO, MEX.—The Mayo River Power & Land Company, which has its headquarters at Denever, Colo., is preparing to erect hydroelectric plants on the Mayo River in the State of Sonora, Mex. Surveys have been made for a series of dams to be built on the river, the first of which will be located near the San Bernando. It is stated that the intial plant will have an output of about 25,000 hp. The other plants will be built as the demand for power increases. The company owns the power concession which was originally obtained from the Mexican Government by W. O. Temple, of Denver, Col. The company is capitalized at $5,000,000. R. M. Jones, of Denver, Col., is hydraulic engineer, and R. E. Cowden, superintendent.

New Industrial Companies.

WILLIAM A. EVANS COMPANY, of Camden, N. J., has filed articles of incorporation with a capital stock of $50,000 for the purpose of doing a general electrical and mechanical engineering business. The incorporators are: W. A. Evans, C. R. Powell, W. J. McGinty, J. V. Colfitts and F. Vreeland, of Camden, N. J.

THE FARKAS TUNGSTEN LAMP COMPANY, of New York, N. Y., has been incorporated with a capital stock of $50,000 to manufacture lamps and electrical apparatus. The incorporators are: K. Farkas, G. V. Williams and W. L. Forbes, Jr., of New York.

THE FLANDRAU MOTOR CAR COMPANY, of West Nyack, N. Y., has been chartered by D. T. Wilson, K. U. Wilson and W. Moffat, of New York, N. Y. The company is capitalized at $52,500 and proposes to manufacture motors, engines, machines, etc., cars, flying machines, etc.

THE KEYSTONE CONTRACTING COMPANY, of New York, N. Y., has been chartered by R. H. Hibbard, F. J. McCann, of New York, N. Y., and W. S. Carter, of St. Louis, Mo. The company is capitalized at $50,000 and proposes to construct docks, railroads, subways, etc., and do a general contracting business.

THE LONDON CONTRACTING COMPANY, of New York, N. Y., has been incorporated by J. Brohm, C. F. McManus and W. A. Walling, of New York, N. Y. The company is capitalized at $1,000,000 and proposes to do a general contracting business, build bridges, ships, cars, etc.

THE MICHAELS & MINICK CONSTRUCTION COMPANY, of Marion, Ind., has been incorporated with a capital stock of $25,000. The company proposes to do a general construction business, but will make a specialty of building electric railroads. Charles A. Michaels, Robert J. Spencer and William H. Minick are directors.

THE NATIONAL ENGINEERING & CONSTRUCTION COMPANY has filed articles of incorporation with a capital stock of $500,000. The incorporators are: W. S. McGuire, of New York, N. Y.; J. D. Fackenthal, of Brooklyn, N. Y., and J. W. Williams, of Weston, Pa.

THE POWER EQUIPMENT COMPANY, of Camden, N. J., has been incorporated with a capital stock of $125,000 to manufacture engines, machinery, etc., by O. M. Scifie, of Philadelphia, Pa.; C. S. Eves, of Jenkintown, Pa., and F. Ferguson, of Camden, N. J.

THE RELIABLE ELECTRIC COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $30,000 to manufacture electrical supplies and equipment. The incorporators are: F. W. McNeal, O. C. Junge and G. W. Rodormer.

THE J. B. RILEY ELECTRIC COMPANY, of Terre Haute, Ind., has been incorporated for the purpose of installing electrical plants and to deal in electrical supplies and appliances. J. B. Riley, Harley Wadkins and J. E. Carter are directors.

THE SAUER POWER GENERATING COMPANY, of Camden, N. J., has been incorporated by Adelbert Sauer, Herman J. Veegite and V. A. Murray. The company is capitalized at $100,000 and proposes to manufacture, sell and lease motors and engines.

THE SAVANNAH HYDRO-ELECTRIC CONSTRUCTION COMPANY, of Savannah, Ga., has been incorporated with a capital stock of $300,000 by G. H. Miller, S. J. Platsch and others. The company proposes to construct a hydroelectric power plant on the Connoche River, 40 miles from Savannah. D. G. Zeigler & Company, of Jacksonville, Fla., are engineers in charge.

THE VIRGINIA ELECTRIC COMPANY, of Richmond, Va., has been chartered with a capital stock of $10,000 to deal in electrical supplies. The officers are: H. S. Hewitt, president; J. R. Tucker, vice-president, and Percy Montague, Jr., secretary and treasurer.

THE VIRGINIA ELECTRIC & MACHINE WORKS, of Charleston, W. Va., has been incorporated with a capital stock of $50,000 by Edwin M. Keatley, James F. Schwalm, A. W. Fitzwater and others.

THE WATSON STORAGE BATTERY COMPANY, of Memphis, Tenn., has been chartered by H. D. Hattel, C. J. Watson, Jr., M. B. Cooper and others. The company proposes to manufacture storage batteries.

THE WESTERN ENGINEERING COMPANY, of Dallas, Tex., has been incorporated with a capital stock of $25,000 to do a general engineering business. The incorporators are: Arthur A. Vardell, Jerome B. Dale, George T. Baldwin and Robert Kaye.

THE WESTPHAL POLPHONE COMPANY, of Camden, N. J., has been chartered with a capital stock of $30,000 to manufacture telephonic devices. The incorporators are: F. R. Hansell, George H. B. Martin and I. C. Glow, of Camden, N. J.

New Incorporations.

PETALUMA, CAL.—Articles of incorporation have been filed for the Petaluma Rural Telephone Company by D. M. Winans, T. G. King, George B. Robinson, S. L. Stice, E. P. Long and Frank Whitlach. The company is capitalized at $50,000 and proposes to construct and operate rural telephone lines, extending from Petaluma.

McINTOSH, FLA.—The McIntosh Telephone Company has been incorporated to establish a telephone line from McIntosh to Evinston by S. H. Walkup, president; E. W. Rush, vice-president; H. L. Dickson, secretary and treasurer, and W. E. Allen, manager.

IRWINTON, GA.—The Irwinton Railway Company has been chartered with a capital stock of $15,000 to construct an electric railway from McIntyre to Irwinton, a distance of 3¾ miles. The incorporators are: J. L. Byington, J. W. Lindsey, G. H. Carswell, I. B. Stinson and I. E. Burkett.

CHICAGO, ILL.—The Thayer Junction Railway Company has been chartered by A. L. Sweet, Walter Famer and E. E. Jones. The company is capitalized at $65,000 and proposes to construct and operate a railway from Thayer to Thayer Junction, Ill.

EVANSVILLE, IND.—The Evansville Public Service Company has been incorporated for the purpose of establishing and operating a central electric light, power, steam and hot-water plant in this city. The company promises to furnish electricity at 7½ cents per kw-hour, a reduction of 25 per cent from the present rates paid by the city and private consumers. The plan is to supply the business districts with steam heat and the resident sections with hot-water heat. The city is to receive 50 per cent of the net earnings of the company after deducting 6 per cent on the capital stock invested. The company is to be capitalized at $1,000,000. Work on the plant will commence early next spring.

SYRACUSE, IND.—The Syracuse Power & Light Company has filed articles of incorporation with the Secretary of State with a capital stock of $50,000. The object of the company is to supply light, heat and power in Kosciusko and Elkhart counties. The directors are: J. P. Dolan, L. A. Neff, H. D. Boozer, Charles Crow and A. B. Dolan. This company has constructed a dam in the Elkhart River and is reported to be generating electricity and distributing the same to farmers and townspeople in Syracuse and other towns nearby. The line in operation is six miles in length, but this will be extended to take in additional territory.

IOWA CITY, IA.—Articles of incorporation have been filed for the Iowa City, Ottumwa & Southeastern Electric Railway Company by S. J. Smith, Roscoe Wilson, Frank Farmer, of Iowa City, Ia., and G. P. Peterson, of Pierre, S. D. The company is capitalized at $2,500,000 and proposes to construct an electric railway 80 miles in length, connecting Iowa City and Ottumwa, Ia. Under its charter the company is authorized to furnish electricity to towns along the route of its railway.

PORTLAND, IA.—Articles of incorporation have been filed for the Pleasant Hill Telephone Company with a capital stock of $10,000 for the purpose of constructing and operating a telephone system. The officers of the company are: Grant McDowan, president; F. M. Brown, vice-president; J. S. Wilcox, secretary, and Henry Siewertsen, treasurer.

FREEBORN, MINN.—The Freeborn Telephone Exchange Company has filed articles of incorporation with the Secretary of State with a capital stock of $5,000. The incorporators are: Fred Feine, A. E. Gilmore and J. B. Purdue.

TINTAH, MINN.—The Tintah Telephone Company has been incorporated with a capital stock of $10,000 by G. W. Mace, J. R. Davidson, M. E. Coleman, J. P. Dahlquist and others.

KALISPELL, MONT.—The Root Mountain Water Power Company has been incorporated with a capital stock of $100,000 by N. Farrar and others. The company proposes to develop water power in the Flathead Valley to be utilized to generate electricity.

LEWISTOWN, MONT.—The Spring Creek Power & Electric Company has been incorporated to construct electric power plants and railways, etc.

SANTA FE, N. M.—Articles of incorporation have been filed for the Montana Power & Irrigation Company with a capital stock of $100,000. The directors are: G. F. Flick, F. C. Wilson and J. A. Massie.

LONG BEACH, N. Y.—The Long Beach Power Company has been incorporated with a capital stock of $200,000 by L. G. Wallace and A. B. Cadley, of Brooklyn, N. Y., and G. G. Fry, of Mamaroneck, N. Y. The company proposes to furnish electricity for lamps, heat and motors.

PARK RIVER, N. D.—The Park River Telephone Company has filed articles of incorporation with a capital stock of $20,000. The incorporators are: John A. Dunn, T. F. Waugh, E. Thornberg and others, of Park River, N. D.

VERMILLION, OHIO.—Articles of incorporation have been filed for the Farmers' Telephone Company, of Vermillion, with a capital stock of $10,000. The Bell Telephone Company has erected an exchange from which telephone lines will be extended through the corporation and township. The incorporators are: G. W. Shattuck, M. D. Power, W. J. Newburg, G. E. Leiber and H. W. Church.

THOMAS, OKLA.—The Farmers' Telephone Company has been chartered with a capital stock of $5,000 by W. A. Mechel, S. J. Hendry, T. C. Cooke and J. S. Houston and others, all of Thomas.

WOLF (P. O. MAUD), OKLA.—The Wolf Telephone Company has been incorporated with a capital stock of $2,000 by J. W. Villenes, S. W. Snyder, L. B. Kirker, J. D. McCraw and W. A. Cope, of Maud.

EUGENE, ORE.—The Eugene Heating & Electric Power Company has been incorporated by S. H. Friendly, J. D. Matloch and Eli Bang, with a capital stock of $15,000.

LEBANON, PA.—The Richland Electric Company has been incorporated with a capital stock of $5,000.

McKEESPORT, PA.—Articles of incorporation have been filed for the McKeesport Belt Line Street Railway Company for the purpose of constructing a street railway on the outskirts of McKeesport, two miles in length. The company is capitalized at $12,000 and the directors are: S. D. Foster, president; D. A. Foster, A. D. Foster and W. E. Hartman.

WILKESBARRE, PA.—The Wilkesbarre Railway Company has been chartered with a capital stock of $10,000 to construct and operate electric and cable railway.

BROOKINGS, S. D.—The Brookings County Telephone Company has been incorporated to take over the plant and holdings of the Thompson, Caldwell & Wilson Telephone Company.

AUSTIN, TEX.—Articles of incorporation have been filed for the New Sweden Telephone Company, of New Sweden, Travis County, with a capital stock of $3,500 by J. A. Stroburg, E. L. Landahl, A. F. Anderson and others.

WESTBY, WIS.—The Timber Conlie Co-operative Telephone Company has been incorporated with a capital stock of $680 by Torval Overhagen, Ole J. Dahl, Carl Clementson, Olaf Peterson and Amund H. Lund.

Personal.

MR. W. W. BRIGGS, manager of the San Francisco office of the Westinghouse Electric & Manufacturing Company, has gone to Honolulu on a business trip.

MR. F. V. T. LEE, assistant general manager of the Pacific Gas & Electric Company, of San Francisco, is absent on a two months' sea voyage. He will return from Australia early in January.

MR. RALEIGH C. THOMAS, city surveyor of Baltimore, Md., is being prominently mentioned for the position of assistant electrical engineer of that city. Mr. Thomas was formerly connected with the electrical commission, or subway department.

MR. A. T. THORP has been appointed resident engineer for the Herkimer County Light & Power Company at Little Falls, N. Y., to fill the vacancy caused by the resignation of Mr. H. F. Dennis, who has entered the employ of the Southern California Edison Company, Los Angeles, Cal.

MR. HUGH C. BAKER, who owned the first telephone exchange in Canada and who obtained the original charter for the Bell Telephone Company of Canada, has retired from the position of manager of the Ontario department, which he has held since 1880, to become special agent for the company.

MR. T. W. BORTHEN, of Trondhjem, Norway, has been appointed superintendent of the new 120,000-hp power station of the Rjulsanfos Company, now under construction at Rjulsan, Norway, and recently described in these columns. Mr. Borthen is at present in charge of the construction of a hydroelectric power station for the municipal electricity works of Trondhjem and will enter on his new work about Jan. 2, 1910.

MR. WILLIAM A. HOUSE, president of the United Railways of Baltimore, is taking an interest in the Red Cross stamp movement. By his order a placard was placed on the front of each car which bears the inscription "Everybody Helps," and below this is a picture of the stamp itself. The Chesapeake & Potomac Telephone Company is also helping the cause.

MR. EDWARD R. TAYLOR delivered an address before the New York State Waterways Association at Albany on December 1 entitled "Co-ordination of Water Interests." He advocated the storage of water

for canal purposes, the surplus being used for generating electrical energy, and mentioned the possibility of manufacturing finished products from the raw materials while in transit along the canals.

MR. T. C. MARTIN, executive secretary of the National Electric Light Association, will deliver an address on "The Status of Our Electrical Art" on Dec. 16, at St. Louis, before the League of Electrical Interests, of which Capt. Robert McCulloch is president and Mr. Walter Robbins secretary. This body formed not long ago to unify the electrical interests of the city and promote the common welfare, and a large and growing membership.

MR. ARTHUR WILLIAMS presided as host at a very interesting little banquet given at the Union League Club, New York, on Dec. 9. Among those present were Mr. Thos. A. Edison, as guest of honor, and Mr. Edward H. Johnson, the latter of whom spoke, although there were no formal speeches. The room was most tastefully converted into an electrical arbor by Singer, and the dinner was followed by a program of excellent vaudeville. On the ménu were clever outline portraits of the guests.

DR. A. E. KENNELLY is the author of a paper on "The Equivalent Circuits of Composite Lines in the Steady State," which appears in the November issue of the *Proceedings* of the American Academy of Arts and Sciences. The current volume of the *Proceedings* of the American Philosophical Society contains a paper by the same author entitled "The Linear Resistance between Parallel Conducting Cylinders in a Medium of Uniform Conductivity."

MR. G. LOUIS BOSSEVAIN. of the New York banking firm of Kean, Van Cortland & Company, has been elected president of the Netherlands Tramways Corporation, to succeed Mr. Henry J. Pierce, resigned, and Mr. W. Barklie Henry, of Philadelphia, has been elected vice-president, in place of Mr. Bossevain. The company, which is incorporated in Connecticut, owns all the street railways of Haarlem, Holland; a line from that city to Zandvoort, on the North Sea, next to Scheveningen, the largest Dutch seaside resort, and a line from Haarlem to Amsterdam.

MR. W. C. WEBSTER, manager of the Westinghouse Electric & Manufacturing Company in New York, has resigned his position and will probably terminate his connection with the company about the first of the year. Mr. Webster's experience with the Westinghouse interests has been quite varied and extensive for the past 12 years. His first position was in the sales department at East Pittsburgh. He later became assistant vice-president, with headquarters in New York, and for the last few years has been the New York manager, having in charge the New York end of the company's business. Mr. Webster as yet has made no plans for the future.

Trade Publications.

TUNGSTEN LAMPS are briefly described in leaflet No. 3766 of the General Electric Company, Harrison, N. J.

DRAWING TABLES for the use of contractors, manufacturers, technical schools, etc., are illustrated and described in a 48-page catalog of the Economy Drawing Table Company, Toledo, Ohio.

POLYPHASE MOTORS.—The Wagner Electric Manufacturing Company, St. Louis, Mo., has issued bulletin No. 89 dealing with automatic acceleration polyphase induction motors which are fully described and illustrated.

LIGHTNING ARRESTERS, of the automatic fusible type. arranged for handling successive discharges without heating, are well described in a booklet of the Automatic Fusible Lightning Arrester Company, Colorado Springs, Col.

CENTRIFUGAL PUMPS, well arranged for operation by electric motors, steam or water turbines, gas or steam engines, are thoroughly discussed in catalog C of the Alberger Pump Company, 95 Liberty St., New York.

HOLIDAY SUGGESTIONS—The Central Electric Company, Chicago, Ill., has issued a new 12-page booklet entitled "Holiday Suggestions," which describes a complete line of Christmas tree outfits, toys, vibrators, electrical heating devices, etc.

LAMP FOR WHITE LIGHT.—The Moore Electrical Company, 169 Malvern Street, Newark, N. J., has issued booklet No. 22 devoted to its vacuum-tube lamp which gives white light. It is said that this lamp is without a rival for location where colors are to be matched and that it is being widely introduced in the textile industry.

RYERSON'S REFERENCE BOOK.—Joseph T. Ryerson & Son, of Chicago, have issued a new edition of "Ryerson Reference Book," which is a comprehensive list of iron and steel specialties and machinery carried by that house. The book contains 364 pages and embraces in compact form a great deal of information useful to engineers, architects, contractors and others interested in iron and steel products.

MOTOR FIELD RHEOSTATS.—The Ward Leonard Electric Company devotes sections of its new perpetual catalog to motor field rheostats and to motor field rheostats equipped with no-voltage release. There is also shown a small panel, for use with variable speed motors, consisting of a snap switch and fuses and a no-voltage release field rheostat, the arrangement being intended for use where starting resistance is not used, and the entire speed control is by field regulation.

MULTILETS.—The Sprague Electric Company is sending out a folder (No. 434) describing and listing its line of stamped steel knock-out boxes known as "Multilets." As the name implies, one box is intended for many uses. The boxes are made in two sizes with a set of covers for each size, and can thus be used for any necessary combination with rigid conduit and Greenfield flexible steel conduit. They accommodate standard fittings and do not require special fittings for special work.

SMALL POLYPHASE MOTORS.—Bulletin No. 4691, issued by the General Electric Company, describes motors for use in connection with the smaller machines found in machine shops. Accompanying this bulletin is a diagram giving the dimensions of the motors of various sizes, the horse-power rating, synchronous and full-load speeds. This publication describes both single-phase and polyphase motors of types which can be arranged for use not only in a horizontal but in a vertical position.

LAUNDRY MOTORS.—"Motor Drive in the Laundry" is the title of publication No. 117, recently put out by the Crocker-Wheeler Company, of Ampere, N. J. The application of electric motor drive to laundry machinery has brought about greater cleanliness, better light, saving in power, increased output, saving in repairs, greater comfort to employees and greater flexibility of location of machines. The pamphlet is profusely illustrated with halftone engravings and many of these tell the story in themselves.

SYSTEM OF UNDERGROUND TRANSMISSION.—The Dielectric Company of America, Belleville, N. J., has issued a bulletin describing its system of underground transmission for power and lighting circuits. The essential and distinctive features of the system are the compound and insulators with their supports. The conductors are held on special porcelain insulators in a wooden box or trough, and are surrounded with "Dielectric." Bare copper is used, and the box serves merely as a mold or form for the insulating compound. The system is said to be applicable for any length of line and for any voltage.

FEED-WATER FILTRATION.—James Biggs & Company, 109 Liberty Street, New York, have issued a new, enlarged edition of "Feed Water Filtration," which explains how oil, dirt, etc., get into feed water, what damage they do within the boilers, and how to remove such impurities before this can occur. It shows how water of condensation and returns from heating systems may safely be used to cut down the coal and water bills, and explains the advantages and disadvantages of various methods of filtration. The Blackburn-Smith feed-water filter and grease extractor is described in detail.

Business Notes.

THE TREBERT GAS ENGINE COMPANY has moved its factory from Rochester, N. Y., to Butler, Ind. The new plant has a greatly increased capacity and is more centrally located to handle business.

THE TUNGSTOLIER COMPANY, Cleveland, Ohio, at a recent meeting elected the following officers: E. J. Kulas, president; W. H. Wissing, vice-president and general manager; T. M. Roche, secretary and field manager.

THE NEWHUB ELECTRIC COMPANY, of 227 West Exchange Street, Akron, Ohio, announces that it will hereafter conduct in its name the business formerly carried on by the Union Manufacturing Company. of Akron, Ohio.

P. E. CHAPMAN, who has purchased the business of the J. G. Barr Electric Company and the Geo. T. Dougherty Electric & Manufacturing Company, has moved his office from 17 North Tenth Street to the northeast corner of Tenth and Walnut Streets, Philadelphia.

EDWARD J. O'BEIRNE & COMPANY, Elgin, Ill., consisting of Edward J. O'Beirne, M. H. O'Beirne and C. G. Harper, has succeeded to the engineering business of Edward J. O'Beirne and the contracting business of the General Contracting Company. The firm controls the Gainesville Electric Company, of Gainesville, Texas, and Washita Electric Power Company, of Pauls Valley, Oklahoma, and will manage the plants of both companies.

DIAMOND RUBBER CHICAGO BRANCH.—The complete stock of rubber-covered wires and cables of the Diamond Rubber Company, which has been carried for some time at 211 Lake Street, has been transferred to the regular Chicago branch of the Diamond Rubber Company, located at 1523 Michigan Avenue. This stock includes practically the complete line of 30 per cent para, red-core and black-core, lead-encased cables, igniter cables, etc. Mr. W. I. Morrow, formerly of the Akron office, is in charge.

STERLING ELECTRIC COMPANY.—Mr. Thomas Duncan, managing director of the Duncan Electric Manufacturing Company and the Duncan Electric Transformer Company, of Lafayette, Ind., has been elected president of the Sterling Electric Company to succeed Walter Doolittle, resigned. Mr. Duncan has been a stockholder in the Sterling Electric Company for some time, has a wide acquaintance in the electrical world and is the inventor of a number of electrical devices. The Sterling Electric Company employs 400 men.

PARTRICK, CARTER & WILKINS COMPANY, Philadelphia, the old-established manufacturers of annunciators, burglar alarms, bells and other electrical house goods, has removed its general offices and salesrooms from Twenty-second and Wood Streets to 122 North Eleventh Street.

The factory will remain where it is, and the moving of the offices and salesrooms will give largely increased factory space. The office and salesrooms are now more centrally located for the convenience of architects and others who desire to show the apparatus in practical operation to their clients. The firm is also selling agent for the line of fire alarms, district boxes, etc., made by the Viaduct Electric Company, Baltimore.

THE WEST STEEL CASTING COMPANY, Cleveland, Ohio, which for the past three years has built up a large trade in medium and small steel castings made by the converter process, has lately enlarged its plant and is now installing crucible furnaces which will supply special small castings demanded by the automobile and general trade. The converter metal will be utilized as heretofore for casting of "West's electrical steel," which is largely used for dynamo frames and other electric castings. This same metal is also found valuable on account of its good strength and ductility for blank gears and general steel castings. The officers of the company are: Ralph H. West (son of Mr. Thos. D. West), president; Everett W. Pike, vice-president, and David P. Lansdowne, secretary.

KEELER BOILERS.—The E. Keeler Company, of Williamsport, Pa., has been awarded the contract by the Pennsylvania Railroad Company for three 408-hp Keeler water-tube boilers, built for a working pressure of 180 lb. per square inch. These boilers will be equipped with Green chain grate stokers, and the setting will be especially designed for this installation for the elimination of smoke in burning soft coal. The contract includes a self-supporting steel stack lined with brick throughout its height, together with the smoke flues and the brick settings for the boilers. This equipment will be installed in the new classification yards at Northumberland, Pa. An order has also been reecived from the United States Engineer Office at Boston, Mass., for three 150-hp water-tube boilers, to be installed in fortifications at Manila. These boilers will be equipped with superheaters. This contract follows a contract for six boilers which was placed early in the year. These boilers are now being installed at Fort Scott, Cal.; Fort Stevens, Ore., and Fort Casey, Wash. The Keeler company has also been awarded the contract for one 500-hp water-tube boiler for the water department for the city of Fort Worth, Texas.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED DEC. 7, 1909.

[Conducted by W. F. Bissing, Patent Law, 2 Rector St., N. Y.]

942,046. PROCESS OF GENERATING AND STORING OZONE; F. M. Ashley, New York, N. Y. App. filed Dec. 15, 1906. Compresses oxygen, cools it, passes it into a chamber in which it receives an electric discharge and then delivers the ozone into a storage tank.

942,050. MOTOR CONTROLLING DEVICE; T. E. Barnum, Milwaukee, Wis. App. filed March 14, 1907. For automatically reversing the motor at intervals for use with washing machines by means of two drum sections on a shaft insulated from each other; contact sections carried by each drum and stationary contact fingers engaged by the contact sections.

942,068. ELECTRIC FURNACE WITH RAISED CHARGING PIT; A. Helfenstein, Vienna, Austria-Hungary. App. filed June 12, 1909. An electric furnace with a raised charging pit with openings in the roof which are closed by removable sand-sealed covers.

942,086. SUPPORT AND INSULATOR; E. F. Lindsay, Pringle, S. D. App. filed April 10, 1909. A divided support and insulator for electric conductors which holds them without tie wires by means of a block having a concave face.

942,091. HARMONIC SIGNALING SYSTEM; R. H. Manson, Elyria, Ohio. App. filed Feb. 8, 1906. Makes use of a source of current delivering energy in successive waves and boosts the available e.m.f. for each recurring wave. Uses an alternating-current translating device, a main source of current supplying energy in flattened waves and a supplemental source impressing synchronous accentuating waves in the circuit.

942,110. ELECTRIC FURNACE; F. T. Snyder, Oak Park, Ill. App. filed Sept. 25, 1906. For smelting ores in which an iron water jacket is used and a tap opening near the top of the crucible with a tube of heat insulating material extending through the wall of the crucible.

942,143. CATENARY SUSPENSION SYSTEM FOR THE TROLLEY WIRES OF ELECTRIC RAILWAYS; K. Von Kando, Vado Ligure, Italy. App. filed Oct. 2, 1908. A supporting arm, an insulator thereon and an intermediate member carried by the insulator to which the suspending wire is adjustably secured.

942,156. GRID RESISTANCE; H. J. Wiegand, Milwaukee, Wis. App. filed March 29, 1909. A grid having portions designed to be engaged by portions of the reinforcing members. Carries lugs with a reinforcing strip covering the edge and having portions bent around the lugs.

942,157. VAPOR ELECTRIC APPARATUS; H. I. Wood, Schenectady, N. Y. App. filed Jan. 18, 1904. A tubular exhausted envelope containing electrodes, a filament extending between them and a coil for magnetically attracting the filament to lift it out of contact with one of the electrodes.

942,186. MAGNETIC CLUTCH; H. W. Ravenshaw, Hanwell, England. App. filed Feb. 28, 1907. An annular electromagnet with annular keeper and an intermediate element having two rings of magnetic material secured together by a flexible ring of non-magnetic material.

942,187. MAGNETIC CLUTCH; H. W. Ravenshaw, Hanwell, England. App. filed Jan. 14, 1908. An annular electromagnet and an annular keeper, consisting of an open ring and a concentric ring sliding in the opening of the open ring.

942,188. MAGNETIC CLUTCH OR BRAKE; H. W. Ravenshaw, Hanwell, England. App. filed March 17, 1908. A magnetic clutch or brake with a boss connecting the driving and driven shaft. Sliding dogs on the boss and a magnetizing coil surrounding them.

942,195. SIGNAL CONTROLLING APPARATUS; W. M. Chapman, Needham, Mass. App. filed April 25, 1908. Contacts arranged to be closed by the trolley of the car and contacts including an insulated rail section closed by the wheels of the car with a signal circuit including both sets of contacts in series.

942,196. APPARATUS FOR CONTROLLING ELECTRIC MOTORS; Harry E. Dey, Jersey City, N. J. App. filed Aug. 6, 1908. A dynamo with a stationary and rotary element, a second dynamo with both elements rotary, one of which is connected mechanically to the rotary element of the first dynamo and a resistance for the field magnet and a counter resistance operated with the load.

942,197. APPARATUS FOR CONTROLLING ELECTRIC MOTORS; H. E. Dey, Jersey City, N. J. App. filed Aug. 8, 1908. Two dynamo-electric machines with one moving element of each machine mechanically connected to the moving element of the other and with the series wire of the field magnet of each machine in circuit with the armature of the other machine.

942,198. APPARATUS FOR CONTROLLING ELECTRIC MOTORS; H. E. Dey, Jersey City, N. J. App. filed May 21, 1909. A number of dynamos, a rheostat for varying the field strength and a pilot motor under the control of a push-button for operating the rheostat.

942,207. PROCESS OF TREATING THE SPENT LIQUOR OF PAPER MILLS; I. Kitsee, Philadelphia, Pa. App. filed Feb. 20, 1903. Subjects the spent liquor to an electric current in the positive compartment of an electrolytic apparatus, the negative compartment containing a second conducting fluid.

942,208. DUPLEX CABLE TELEGRAPHY; Isidor Kitsee, Philadelphia, Pa. App. filed May 20, 1908. A duplex telegraph in which the receiver includes a transformer with the primary in the line, a receiving instrument controlled by the transformer secondary and a third winding on the transformer for neutralizing the effect of the impulses in the transformer secondary.

942,240. PLURAL LAMP-HOLDING DEVICE; R. B. Benjamin, Chicago, Ill. App. filed Aug. 5, 1907. A plurality of radial legs, each carrying an insulating block, the blocks carrying electric contact and lamp-holding devices with a casing enclosing the blocks and devices, the casing having registering openings.

942,241. PLURAL LAMP SOCKET; R. B. Benjamin, Chicago, Ill. App. filed Dec. 28, 1907. A casing for holding lamps, separate outer contacts for the holding means, a separate binding terminal for each contact, a continuous center contact with a binding terminal and a base, which is removable independently.

942,242. PLURAL LAMP-HOLDING DEVICE; R. B. Benjamin, Chicago, Ill. App. filed Dec. 28, 1907. A casing with a back plate and a bowl-shaped shell having lamp openings, an insulating bushing in each, a threaded socket shell in each bushing, an insulating base within the bowl-shaped shell, a contact carried by the base, the shells being electrically connected.

942,248. AUTOMATIC SELF-INDICATING FUSE; F. B. Cook, Chicago. Ill. App. filed March 1, 1909. The fuse is made with a hollow end cap which holds a spring under tension so that when the fuse melts the spring mechanism indicates the disruption of the wire.

942,255. BLOCK SIGNALING SYSTEM FOR RAILWAYS; J. Gaszper, Cleveland, Ohio. App. filed April 29, 1909. Automatically operated by moving trains so as to produce a continuous vibratory and flashing signal and a continuous visual signal when the train is within the block.

942,264. BRUSH HOLDER; A. Kimble, Chicago, Ill. App. filed March 22, 1909. A movable contact with a brush bearing thereon and a ring between the brush and contact with means for releasing the spring when the brush has been worn to a certain extent.

942,279. STORAGE BATTERY; D. P. Perry, Chicago, Ill. App. filed Oct. 12, 1903. A metallic cell, a horizontal cylindrical reticulated negative pole electrode, a cylindric positive electrode within the negative electrode and a cylindric conductor within the positive electrode.

942,308. IRON HEATED BY ELECTRICITY; J. Collicott, Salt Lake City, Utah. App. filed June 8, 1909. An electrically heated flat iron with an adjustable heating unit to which the electric wires are locked.

942,325. ELECTRIC GENERATOR; G. A. Huber, New York, N. Y. App. filed Feb. 10, 1908. A magneto with a fly wheel which drives the generator through a ratchet and pawl connection.

942,332. ELECTRICAL CONDUCTOR; I. Kitsee, Philadelphia, Pa. App. filed April 10, 1908. For telephone currents and the like, comprising conductively independent conductors arranged together, the resistance of the cinductors being half of that between the conductors, and the mutual capacity twice that of the absolute capacity of the conductors.

942,334. MECHANICAL CODE SIGNALING DEVICE; F. A. Meissner, Manchester, Va. App. filed Dec. 11, 1908. For party line telephones in which a plate carries circuit breakers and a circuit closer has a pin which contacts with the plate and also a spring-pressed collar with means for sliding the plate for moving the breaker over the pin and means for disengaging the collar from the edge of the perforation in the plate when the plate reaches the end of its stroke.

942,349. PROCESS OF PRODUCING FERRO ALLOYS; E. F. Price, Niagara Falls, N. Y. App. filed June 1, 1907. Electrically smelts a finely divided charge of a metal compound, a reducing agent and a source of iron and surrounds and protects the reduction zone by a considerable body of the charge, withdrawing the gases beneath the surface of the charge.

942,350. ELECTRIC FURNACE; E. F. Price, Niagara Falls, N. Y. App. filed Jan. 27, 1908. An open vessel, oppositely arranged electrodes extending therein and a stack between the electrodes so that the air current flowing through the stack passes next to the electrodes.

942,378. VAPOR ELECTRIC APPARATUS; L. E. Dempster, Schenectady, N. Y. App. filed March 19, 1904. A plurality of mercury electrodes, a filamentary conductor initially connecting them with means for moving the conductor to break the connection, first at the negative electrode and then at the positive electrode.

942,382. MOTOR CONTROLLER; A. Kimble, Chicago, Ill. App. filed Sept. 7, 1909. For stopping, reversing and controlling a single-phase, alternating-current commutator motor by means of a brush-holder ring which carries brushes bearing upon the commutator and a series of stationary contacts engaged by contact members carried by the ring.

942,396. ELECTRIC DRILL; P. J. Lincoln, Birmingham, Ala. App. filed Nov. 18, 1908. A central field coil with a field coil on each side of the center and an end field coil for each side coil, an armature mounted to reciprocate between them with a drill rod carried by the armature.

942,433. ALARM APPARATUS; H. R. Bretney, Indianapolis, Ind. App. filed Jan. 11, 1909. An alarm apparatus with an indicator including an electromagnet with two coils each with an independent terminal and a brush adapted to be brought into engagement with the terminals.

942,463. METHOD OF AND MEANS FOR REGULATING THE SPEED OF ELECTRIC MOTORS; R. H. Rogers, Schenectady, N. Y. App. filed Aug. 5, 1908. The motor has two field windings and one of the field circuits is kept open when the motor is heavily loaded and closed when it is lightly loaded.

942,468. AUTOMATIC SIGNALING SYSTEM FOR RAILWAYS; G. H. Sloane, Boston, Mass. App. filed May 26, 1908. At each end of the block a semaphore is arranged controlled by a pair of solenoids, which are controlled by a switch shifted by the agency of the car as it approaches the block.

942,488. CONTROLLER FOR ELECTRIC AUTOMOBILES; H. P. Dodge, Toledo, Ohio. App. filed June 5, 1909. A hollow steering shaft for automobiles and a steering handle connected therewith with a case supported by the staff and an electric make and break in the case.

942,491. ELECTRIC SWITCH; W. L. R. Emmet and E. M. Hewlett, Schenectady, N. Y. App. filed Feb. 14, 1901. A base, a movable contact, an actuator, a latch engaging it to lock it to the base, a latch for locking the contact member to the actuator, an electro-responsive means for unlocking the contact member from the actuator.

942,497. SPEEDOMETER; W. R. Harris, Irvington-on-the-Hudson, N. Y. App. filed July 28, 1908. A contact member carried by the pivotal end of a rotating stem with a hand on a shaft making contact therewith during a part of the registering movement thereof. Provides an electric alarm which may be adjusted to give a signal when the vehicle is traveling too fast.

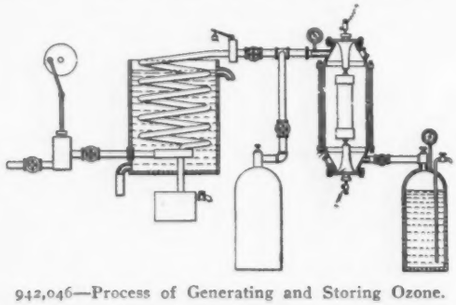
942,508. ELECTRIC CIRCUIT CONTROLLING RELAY; B. Menkin, New York, N. Y. App. filed Feb. 3, 1909. Automatic relay for burglar alarm, in which two circuits are energized from a common source, a third circuit includes a translating device, the first circuit controlling the second and the second the third.

942,513. SINTERING APPARATUS; R. Palmer, Larchmont, N. Y. App. filed Feb. 10, 1909. For welding highly refractory metals like tungsten by compressing the fine metal power into a mold, supplying gas thereto and then passing an electric current therethrough. Water-cooled clamps hold the material to be treated.

942,544. ELECTRIC TRANSFORMER AND GOVERNOR; E. R. Cliff, New York, N. Y. App. filed March 5, 1908. For regulating the strength of current in series arc systems by means of a transformer with a movable coil, the equilibrium between the primary and secondary coil being disturbed which produces the regulation as the load changes.

942,555. ELECTRIC RESISTANCE APPARATUS; M. Hankin, Brussels, Belgium. App. filed Jan. 5, 1909. The powdered resistance material is contained within a case between two terminals, rusty particles of cast iron filling the cases.

942,620. ELECTRIC TELEGRAPHY; J. A. L. Dearlove, London, Eng. App. filed March 1, 1908. For duplexing cables in which the artificial cable is made independent of variations in temperature. The cable is in strip form, having a negligible temperature coefficient, a series of inducing sheets attached thereto, earth plates and dieletric arranged between the conducting and inducing sheets.



942,046—Process of Generating and Storing Ozone.

942,623. AUTOMATIC CUT-OFF; P. Dixon, Atlanta, Ga. App. filed Dec. 20, 1907. For use with incandescent lamps which are automatically cut-off, even though forgotten by the user, from one minute to three hours after leaving it.

942,676. SIGNALING SYSTEM; F. E. Smith, Ames, Iowa. App. filed July 24, 1908. The train sets a distance signal on entering the block and clears it on leaving the block, and a series of controlling circuits are provided, including a trolley conductor, a signal, a movable electro magnet directly actuating the signal, and fixed electro magnets cooperating therewith to reciprocate the movable magnet in the line of travel of the vehicle.

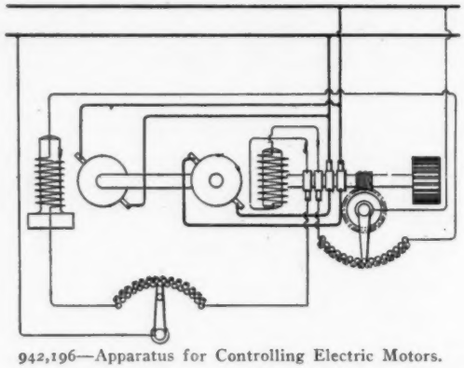
942,704. METHOD OF SECURING METAL CONTACTS TO CARBON ELECTRODES; S. Benko, Budapest, Austria-Hungary. App. filed July 8, 1909. Method of attaching metal contacts to carbon electrodes by heating the head portion of the electrode above the melting point and saturating it with molten metal which is absorbed by the heated carbon.

942,710. CONNECTION ROSETTE FOR ELECTRIC WIRES; J. L. Burton, Plainville, Conn. App. filed July 25, 1908. The fixed base has eccentric grooves carrying contacts and the removable member has curved projections engaging therewith with contact pieces conforming to the projections.

942,722. CONTROLLER REGULATOR; C. M. Feist, Sioux City, Iowa. App. filed June 5, 1909. A controller regulator having a pocket with a depression in the bottom wall with a dog pivoted in the pocket and arranged to drop into the pocket upon injury to its pivot.

942,729. ELECTROLYTE AND METHOD OF ELECTRODEPOSITING NICKEL; E. F. Kern, Knoxville, Tenn. App. filed Sept. 7, 1909. Electrolizes a solution containing fluosilicate of nickel.

942,730. FLAMING ARC-LAMP; G. L. Martin, Brooklyn, N. Y. App. filed Feb. 17, 1909. Feed mechanism for arc lamps, including a rod with feet and a plurality of cams with means for causing the rod to move upwardly and permitting the same to move downwardly and adjustable brackets engaging the cam to move the rod laterally to disengage the pawl.



942,196—Apparatus for Controlling Electric Motors.

942,767. TROLLEY-WHEEL; H. L. Baylies, Chicago, Ill. App. filed April 9, 1909. The hub of the trolley wheel has a concave body serving as an oil chamber and roller bearings are arranged between the inner and outer bearing bodies.

942,787. FLEXIBLE CONDUIT; C. H. Miller, West Pittsburgh, Pa. App. filed July 25, 1907. A non-metallic flexible conduit with a smooth inner layer and a tubular braided fabric surrounding it saturated with fireproof material and a spiral strip of paper surrounding the fabric.

942,788. CONDUIT FOR ELECTRIC WIRES; C. H. Miller, West Pittsburgh, Pa. App. filed July 25, 1907. A flexible conduit having an interlining of woven strips, the weft and warp strips being spirally wound in opposite directions.

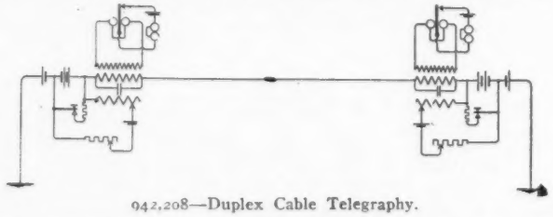
942,789. FLEXIBLE ELECTRIC CONDUIT; C. H. Miller, West Pittsburgh, Pa. App. filed July 25, 1907. Flexible conduit with a woven tubular fabric and a flexible spirally wound wooden strip.

942,790. FLEXIBLE CONDUIT FOR ELECTRIC WIRES; C. H. Miller, West Pittsburgh, Pa. App. filed July 25, 1907. A flexible non-metallic conduit consisting of an inner air and water-tight flexible tube surrounded by a spiral wrapping of paper which is surrounded by a muslin wrapper and this is surrounded by a braided fabric.

942,807. TELEGRAPHIC REPEATING APPARATUS; W. E. Athearn, New York, N. Y. App. filed June 12, 1909. A telegraph repeater with two sections, each comprising a pole changer, a polar relay operable by the pole changer with one section, a neutral relay controlled by the pole relay, extra contacts upon the pole changer and a repeating sounder controlled by the contacts and controlling the neutral relay.

942,814. MULTIPLEX TELEGRAPH; S. D. Field, Stockbridge, Mass. App. filed June 17, 1909. Main and artificial lines, a differentially wound relay with one winding in the main line and the other in the artificial line and the other relay with the coils in the main and artificial lines in bridge relation with the first relay and with an inductive capacity greater than the main line and artificial line coils of the first relay.

942,815. RELAY; S. D. Field, Stockbridge, Mass. App. filed June 17, 1909. For multiplex telegraphs. Has a movable armature, a main electromagnet and a holding electromagnet therefor and an auxiliary electromagnet acting in the same direction of the holding magnet.



942,208—Duplex Cable Telegraphy.

942,844. AUTOMATIC TELEGRAPH; L. M. Potts, Baltimore, Md. App. filed July 6, 1905. Page printing telegraph, in which the sending forms consists of a sheet of paper carrying perforations and the transmitter is a polarized relay and segmental ring forming a sending commutator, the brushes being driven by a motor. The receiving circuit includes a main relay and receiving commutator, and controls printing magnets.

942,867. MAGNETIC CLUTCH; H. W. Ravenshaw, Hanwell, England. App. filed Feb. 28, 1907. A driving and driven shaft, an annular electromagnet with annular keeper and intermediate element through which the magnetic circuit is completed back through the shaft.

942,871. VAPOR ELECTRIC APPARATUS; H. I. Wood, Schenectady, N. Y. App. filed Dec. 17, 1903. A starting device for vapor lamps of the horizontal type by means of an electromagnet which causes an arc started from one electrode to shift to another by disengaging one end of the filament and the electrode on which it rests.

942,874. ELECTRIC HEATER; G. E. Stevens, Lynn, Mass. App. filed May 29, 1907. An electric fluid-heating device in which the fluid is delivered under pressure with means controlled by the pressure for admitting fluid and closing the circuit of the heater.